Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

Vol 21 #230
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DETROIT

On land, at sea
and in the air
M & I products
are everywhere

m and i

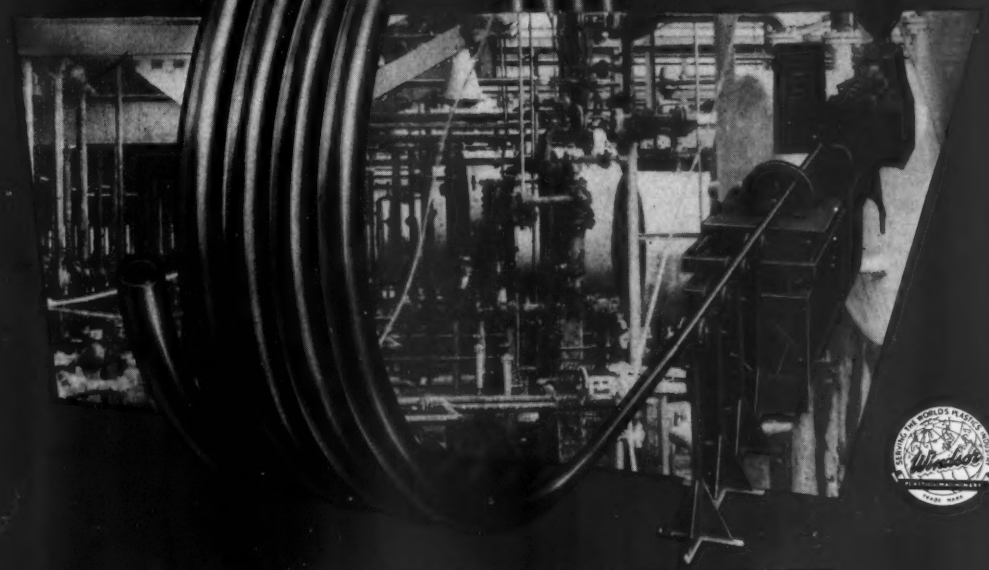
the electrical insulation people

Photographs by courtesy of British Railways, The Cunard Steam-Ship Co. Ltd. and Vickers-Armstrongs (Aircraft) Ltd.

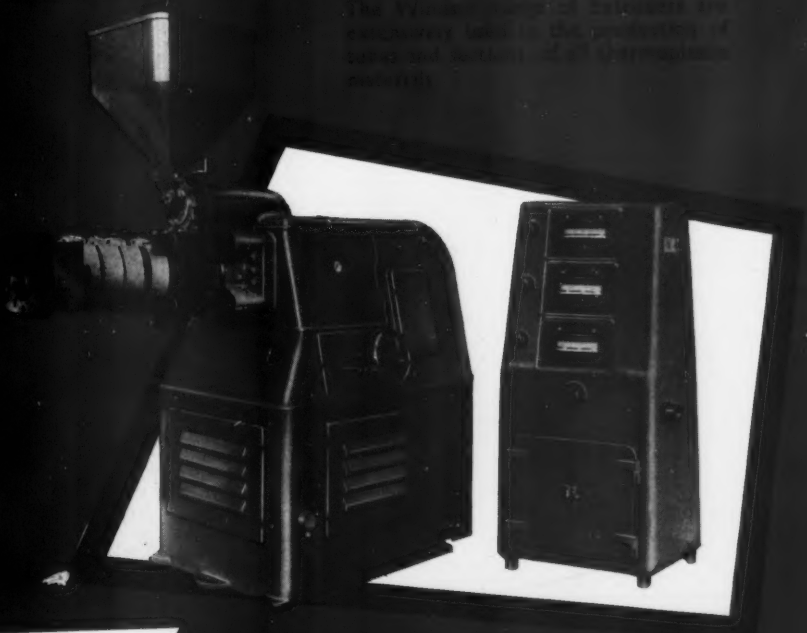
THE MICANITE & INSULATORS CO. LTD., WALTHAMSTOW, LONDON, E.17.
TELEPHONE: LARKSWOOD 5500. TELEGRAMS: MYTILITE, EASPHONE, LONDON

Disc for displaying PIRELLI TYRES
produced by The K. R. Webb Company, Painswick, Glos.
PIRELLI
Erinoid
Styrene Copolymer Sheeting
for vacuum forming

When it's a question of PLASTIC PIPES -



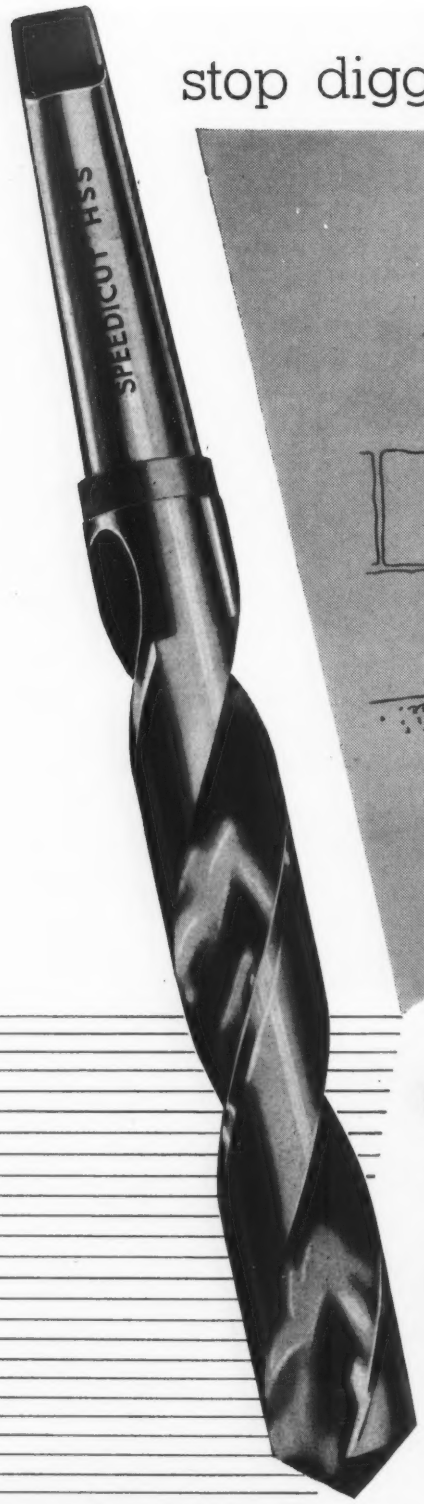
WINDSOR EXTRUSION MACHINES



R.H. Windsor LTD

A

stop digging . . .



drill it
with a

SPEEDICUT
HIGH SPEED STEEL
DRILL

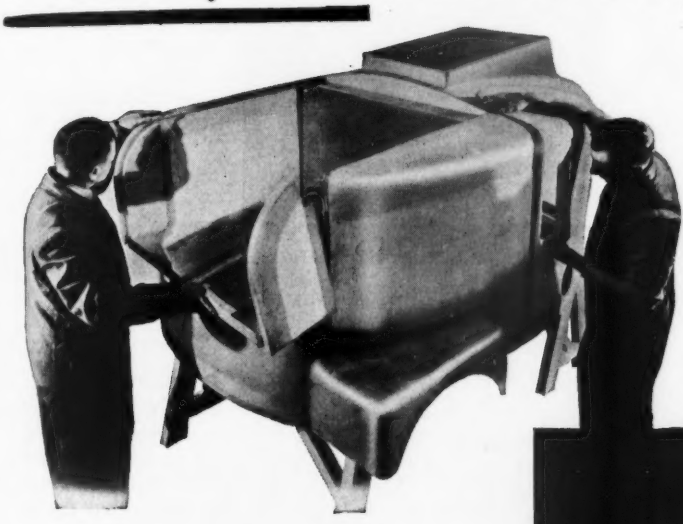
F B T
FIRTH BROWN TOOLS LTD

SPEEDICUT WORKS · CARLISLE STREET EAST · SHEFFIELD

The Shell Petroleum Company has ordered a considerable number of these light, mobile fuel dispensers. A single unit can meter fuel direct from hydrant points to the aircraft tank, in a minimum of time.

Thompsons take to Structural Plastics

for quicker, cheaper production and repair



The rear end apron aperture and door aperture being fitted to the main shell. A self-extinguishing grade of Beetle Polyester Resin is used in the lay-up of all moulded parts.

The large main shell, being removed from the mould, is easily handled by only two men. The complicated mould can be turned through 180°; it is fitted with an air-ejection system for withdrawing the moulding.

The polyester story takes another step forward in the production by Thompson Bros. (Bilston) Ltd., of this mobile fuel dispenser for the Shell Petroleum Company. Here are met important economic and practical requirements — the need to produce relatively small numbers at a reasonable price; the need for a combination of lightness, strength and good corrosion-resistant properties. This can be readily achieved in moulded items large and small, simple or complex, but is always reliably ensured when Beetle — the highest quality polyester resin on the market — is the chosen bonding medium.

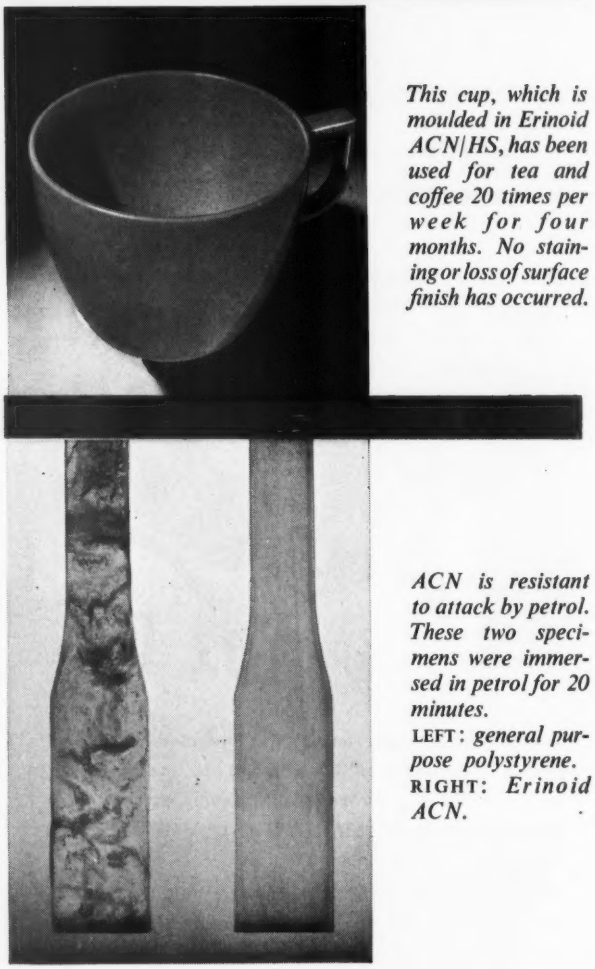
BEETLE polyester resins B·I·P

B.I.P. CHEMICALS LTD., Oldbury, Birmingham · Telephone: Broadwell 2061
London Office: 1 Argyll Street, W.1 · Telephone: Gerrard 7971

Erinoid

ACN grade

STYRENE ACRYLONITRILE COPOLYMER



This cup, which is moulded in Erinoid ACN/HS, has been used for tea and coffee 20 times per week for four months. No staining or loss of surface finish has occurred.

This new grade of styrene co-polymer has a strength 50–100% greater than general purpose polystyrene. It has good resistance to attack by petrol, white spirit, fruit juices, acids, alkalis, fats, inks and disinfectants. Mouldings are not stained by tea or coffee. Metal inserts can be moulded in and the material has excellent electrical properties.

Two grades are available—ACN and ACN/HS. They have similar properties, apart from softening point and flow:

ACN — Softening point: 92°C. (B.S.1493)

ACN/HS — Softening point: 100°-103°C. (B.S.1493)

Both grades are easily moulded and extruded. The base colour is a transparent straw shade and therefore transparent colours, including blue tint, are available.

ACN is resistant to attack by petrol. These two specimens were immersed in petrol for 20 minutes.
LEFT: *general purpose polystyrene.*
RIGHT: *Erinoid ACN.*

This new material is manufactured by

STYRENE PRODUCTS LIMITED

Full information, samples, prices, etc. on application to

ERINOID LIMITED • STROUD • GLOUCESTERSHIRE

Telephone: Stroud 810

LONDON OFFICE: 96 Piccadilly . London W1 . Telephone: GROsvenor 7111

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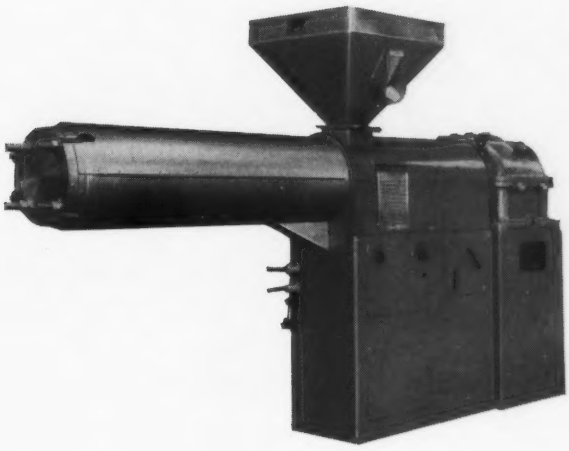
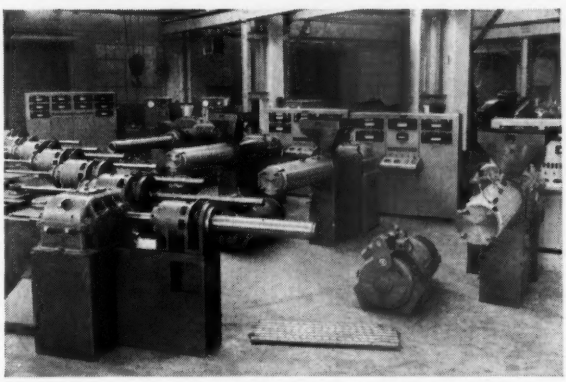


extruders

specially designed for all types of plastics



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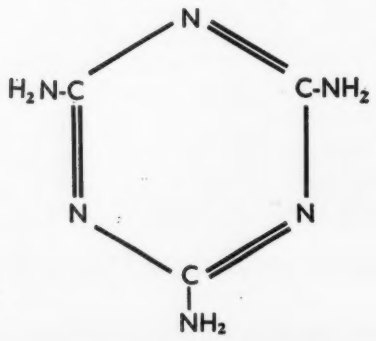
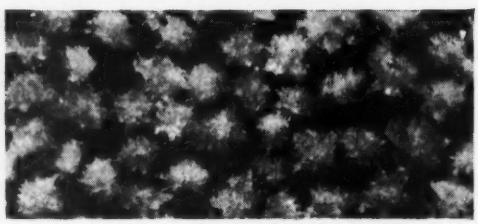
British Oxygen Chemicals make Melamine; names and addresses of manufacturers of Melamine resins and moulding powders will be supplied with pleasure. Please write for further information to:—

British Oxygen Chemicals Limited,
Vigo Lane, Chester-le-Street, Co. Durham.
Tel: Birtley 145
London Office: Bridgewater House, St. James's,
S.W.1. Tel: Whitehall 9777

Melamine





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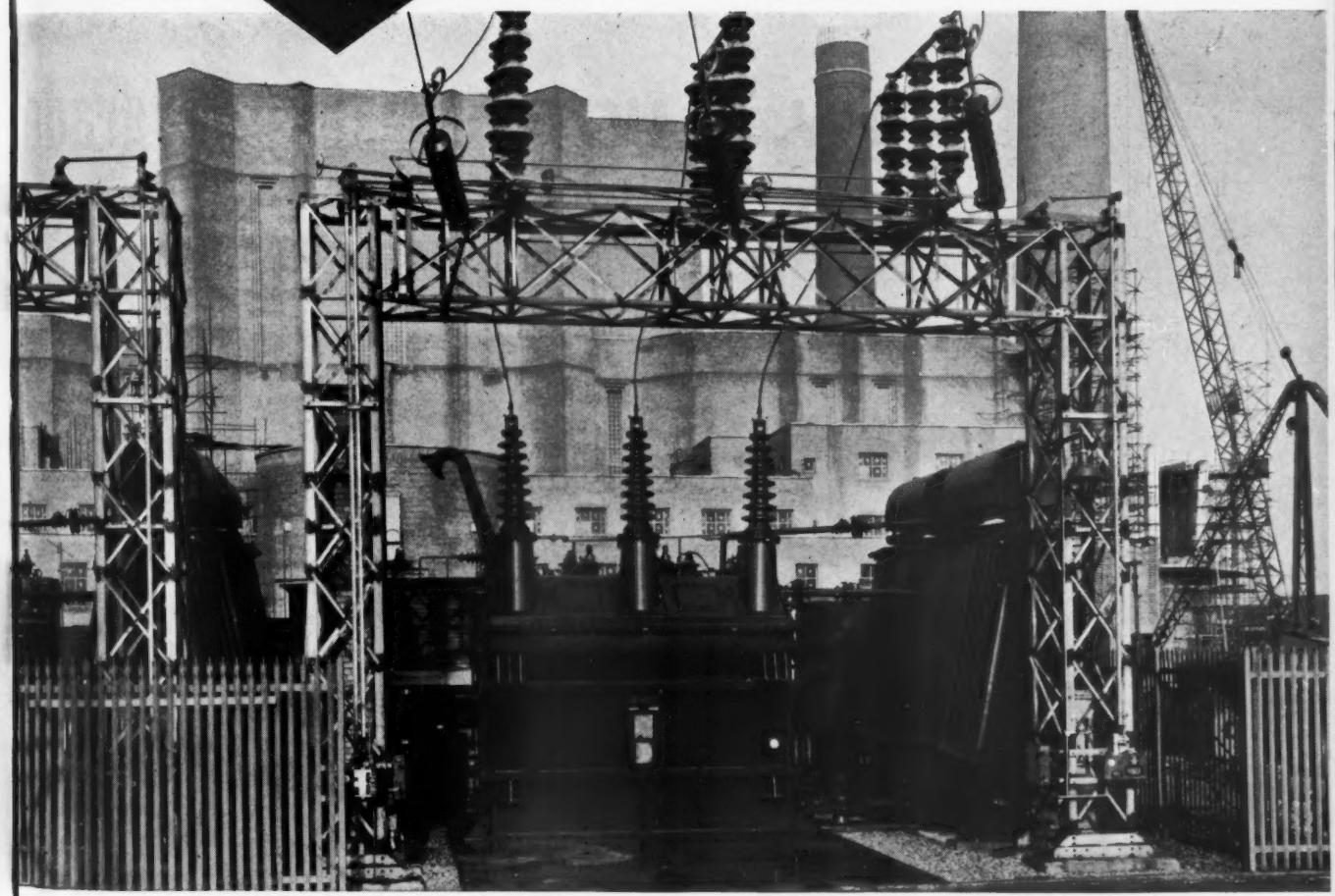

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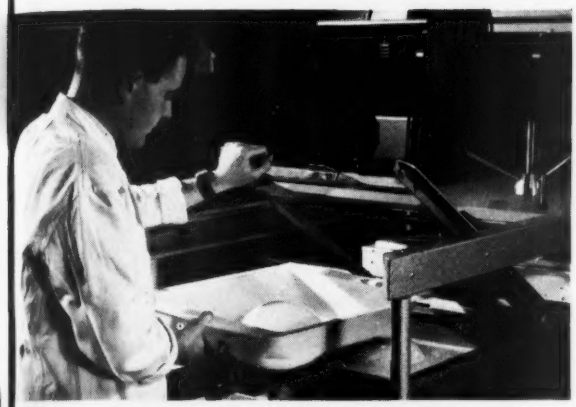

Monsanto Plastics do not supply finished sheet —order supplies from Saro Laminated Wood Products Limited, Folly Works, Whippingham, Isle of Wight, or write to Monsanto for more information and Laboratory Report.

Monsanto announce a new polystyrene grade—*expressly devised for the extrusion of sheet for vacuum-forming*. It's a worthy addition to the high quality Lustrex range. It's called Lustrex Toughened 6—and you can get it, *now*, in sheet form! A glance at the physical properties of T6 will convince you: this new sheet polystyrene is superior to all others available.

Typical properties of Lustrex T6 sheet

		Test Method
Tensile Strength p.s.i.	2800 – 3300	ASTM D. 638-52T
Elongation at Break %	20 – 40	" " "
Modulus of Elasticity in tension p.s.i.	$(3.3–3.8) \times 10^5$	" " "
Izod Impact Strength ft. lb/in. of notch ¼" × ¼"	1.0 – 1.6	ASTM D. 256-47T
Thermal co-efficient of expansion in/in/°F × 10^{-5}	4.0 – 4.5	
Specific Heat cals/°C/gm	0.3	
Specific Gravity	1.05	B.S. 1493
Thermal conductivity cals/cm/°C/sec/cm^2 × 10^{-4}	5.0 – 5.5	
Dielectric constant at 10^6 cycles/sec.	2.5 – 2.8	
Water Absorption %	0.05	

Lustrex is a Registered Trade Mark.

LUSTREX T6 sheeting

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137 Monsanto House, Victoria Street, London, S.W.1
and at Royal Exchange, Manchester, 2.

MONSANTO

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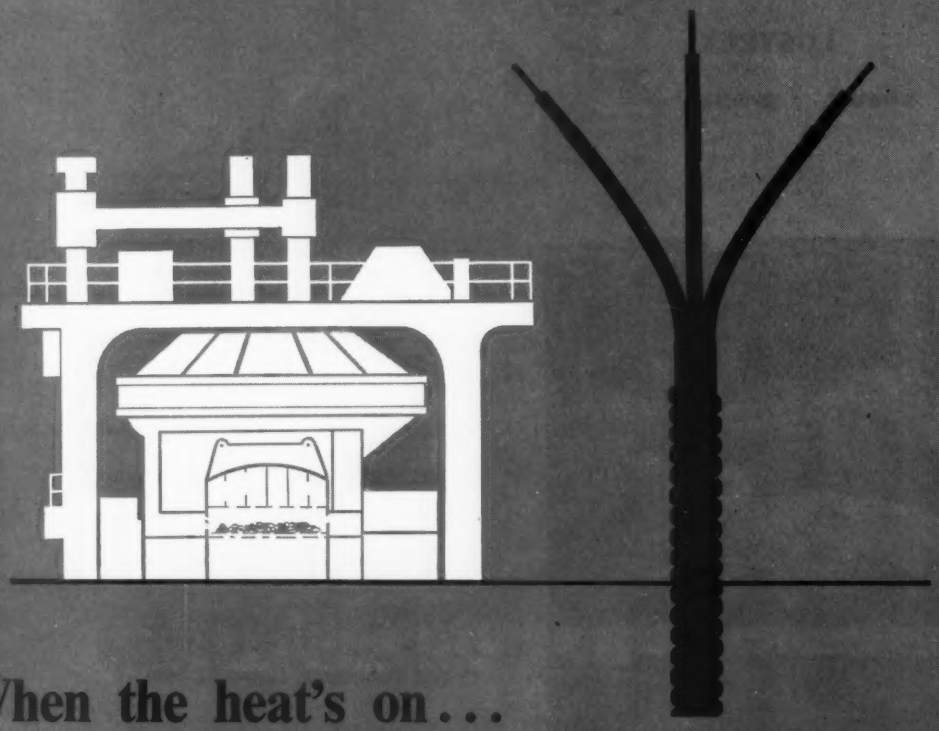

When the heat's on...
cables need I.C.I Silicone Rubber

I.C.I. Silicone Rubbers for cable covering withstand temperatures of 200°C. for very long periods, and much higher temperatures for short periods. This fact alone means greater reliability for cables used at high ambient temperatures. And when I.C.I. Silicone Rubbers do burn—at very high temperatures—they leave a non-conducting siliceous ash which maintains insulation, provided it is not damaged mechanically. This unusual property is an added advantage where risk of breakdown by fire cannot be tolerated.

I.C.I. Silicone Rubber is recommended for covering cables used for pyrometer leads, in boiler rooms, adjacent to furnaces, in mines, and in all equipment liable to frequent or excessive overloading.

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MS. 33

3-Dimensional Display unit formed from **Vitrone** *Clear Rigid Vinyl Sheeting reproduced by courtesy of Cellgrave Co. Ltd.*

Crystal Clear, Opal, and Opaque Rigid P.V.C. Sheeting

Model Police Launch Vacuum-formed from **Vitrone** *Rigid Vinyl Sheeting reproduced by courtesy of Sebel Products Ltd.*

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for the plastic fabricator with something special in mind

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Because **'Celastoid'** is easily formed and does not chip, snap or crack when machined.

Because **'Celastoid'** is ideal for high quality precision work and is used extensively for optical purposes, combining utility with beauty.

Because **'Celastoid'** is shatterproof and tough. For visors, goggles and other safety purposes it is unrivalled.

Because **'Celastoid'** comes in accurately gauged sheets of many colours. It can be laminated for two-tone effects.

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Plastics Division. Celanese House, Hanover Square, London, W.1. Mayfair 8000.

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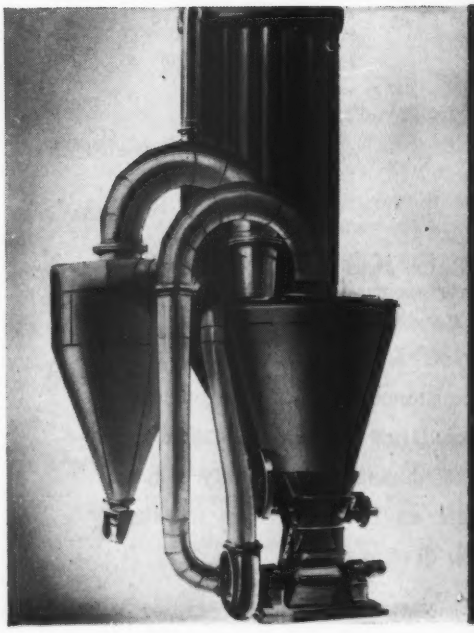
for dustless production
and consistent fineness



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- Combined air separating and conveying systems.
- Dust-free working ensured by vacuum operation.
- Designed for pulverising the softer, non-abrasive materials and for close control of fineness.
- Manufactured in a range of sizes.

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Ambersil has been specially prepared and packed in a 12oz Aerosol container which produces an almost invisible silicone mist. Based on a well-proved silicone fluid, it is the most economical mould lubricant of its kind ever produced. Universal in application.
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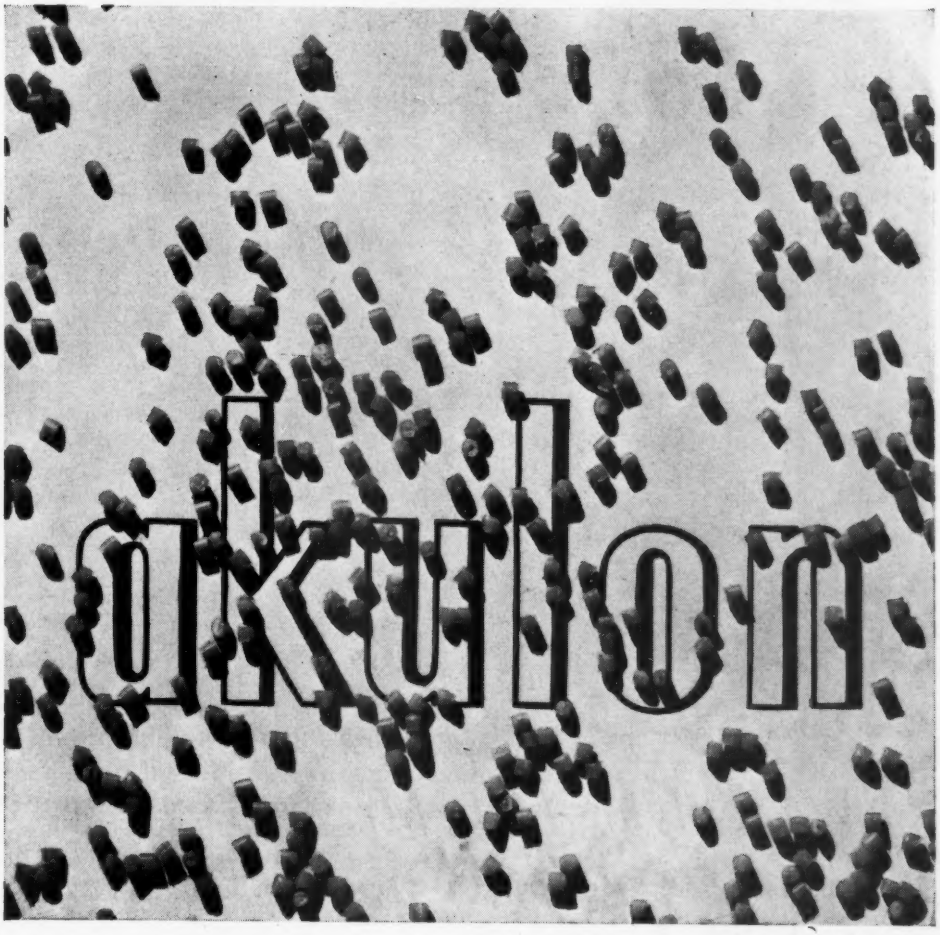

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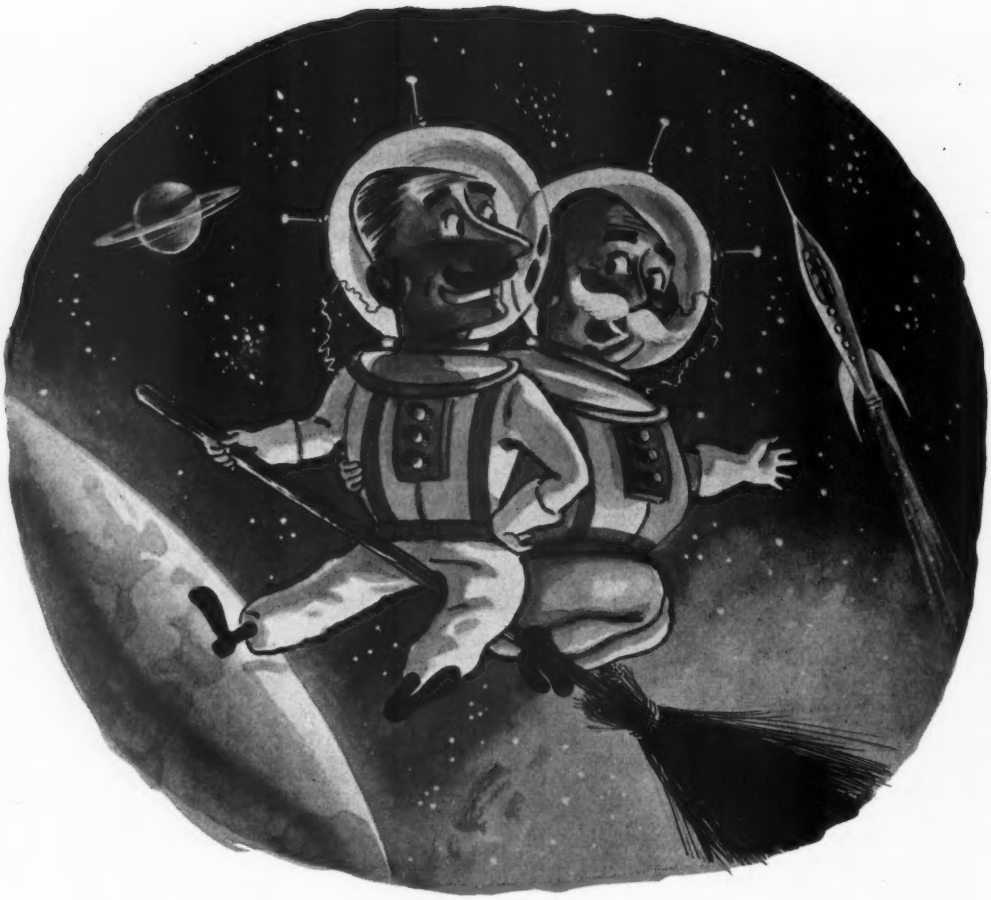

We're flying high, Mr. Ash!

And digging deep, Mr. Downs!

We're a versatile team aren't we!

Let's explain, Mr. Downs.

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Of course not! Every use calls for a particular plastic material and design specifically for that use.

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AND STAYING THERE!

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The Old Boy coughed and we braked heavily.
"Boy" he said "There seems to be some mistake.
Do you suggest we should chaffer in the
market place like some seller of Oriental Rugs?
Am I to become a Super-Salesman?
Do you imply that we are *in competition*
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Well — *do* you? Name them, Sir, name them, for
their names will be news to me".
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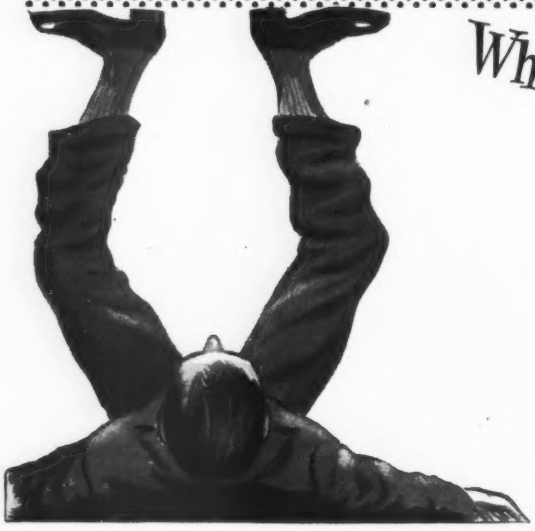
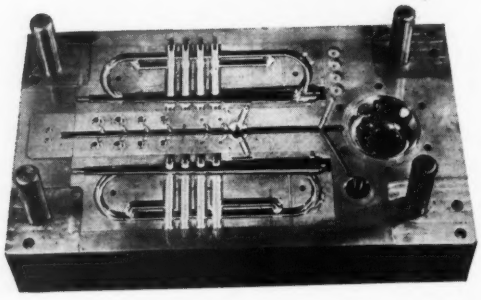
Whatever your position





If you mould plastics, whatever your position in the industry, moulds are important to you. For they govern both the quality and the price of your product.

They are important to us, too, for the design and production of moulds is our business, and we take our business seriously. Because we specialise we can render a specialist service, and help you obtain the maximum efficiency and economy from both your machines and your materials.

May we have the opportunity ?

UNIVERSAL TOOLS LTD

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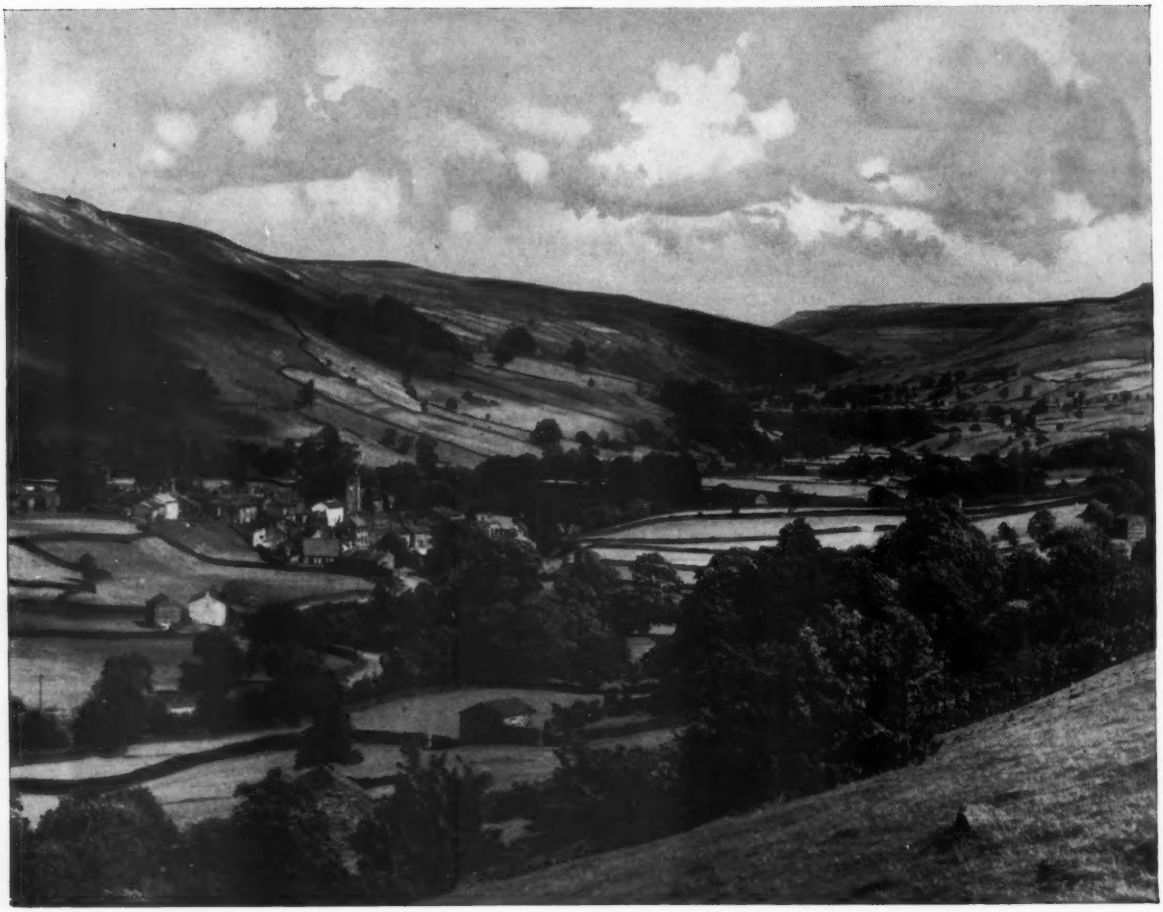

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COMPRESSION MOULD in Double-Six steel for making motor starter control knobs from wood-filled phenolic powder. Hardened and tempered to Rockwell 57 "C" scale. Production 10,000 to date, at temperature of 340–380° F.
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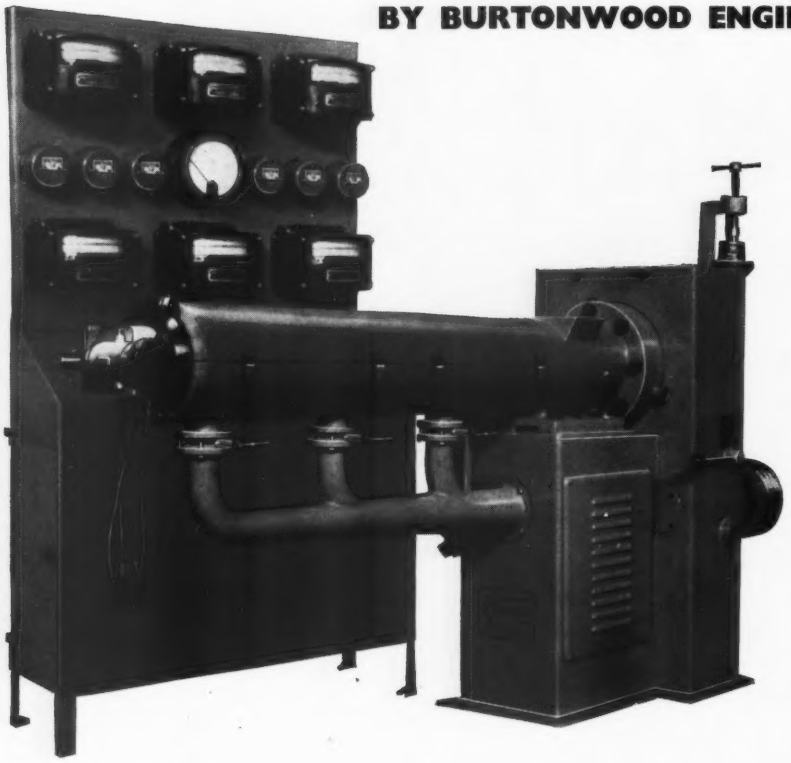

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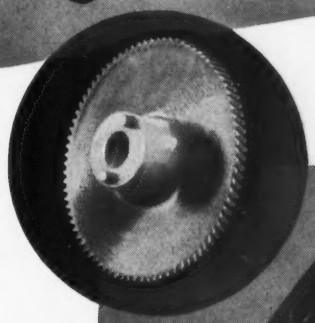

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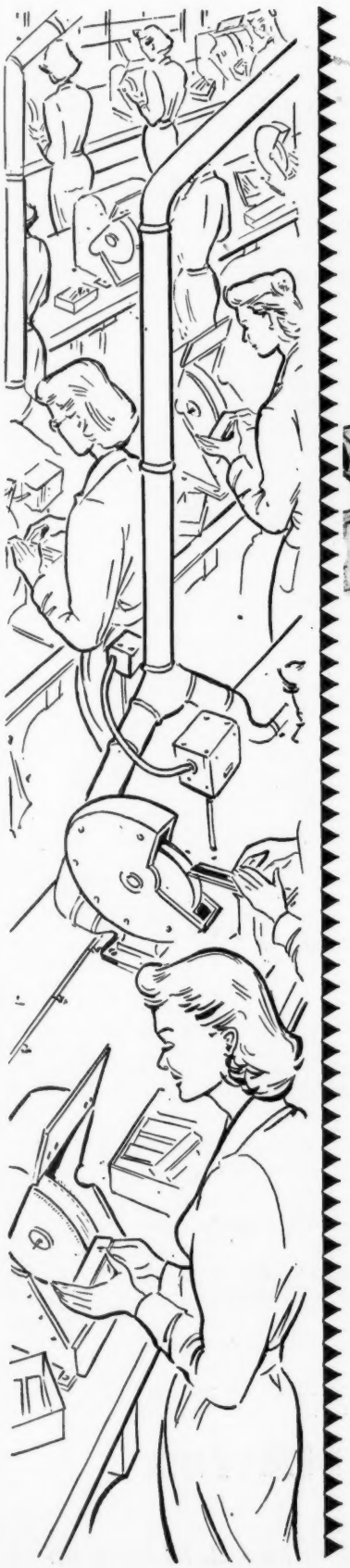

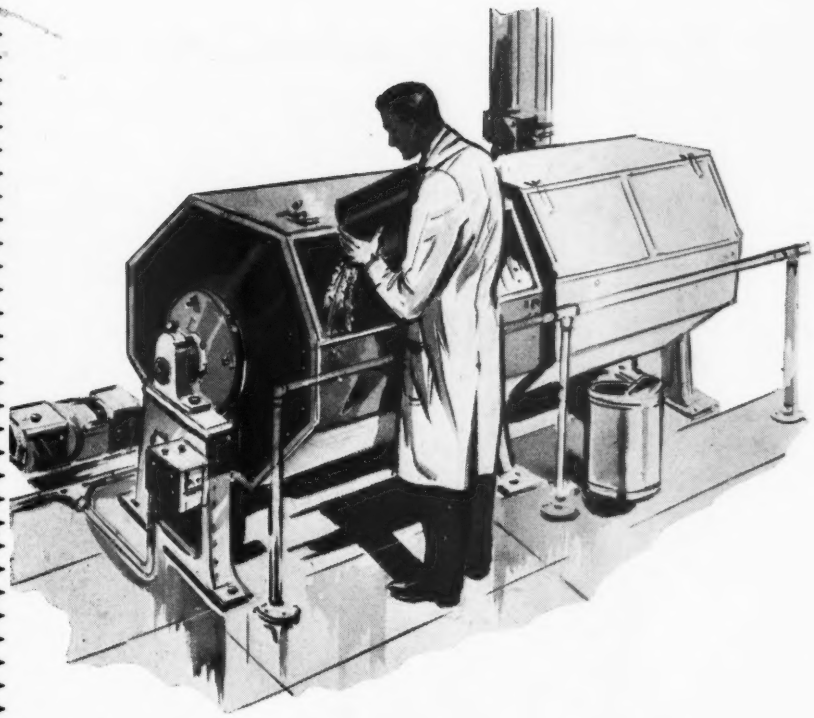

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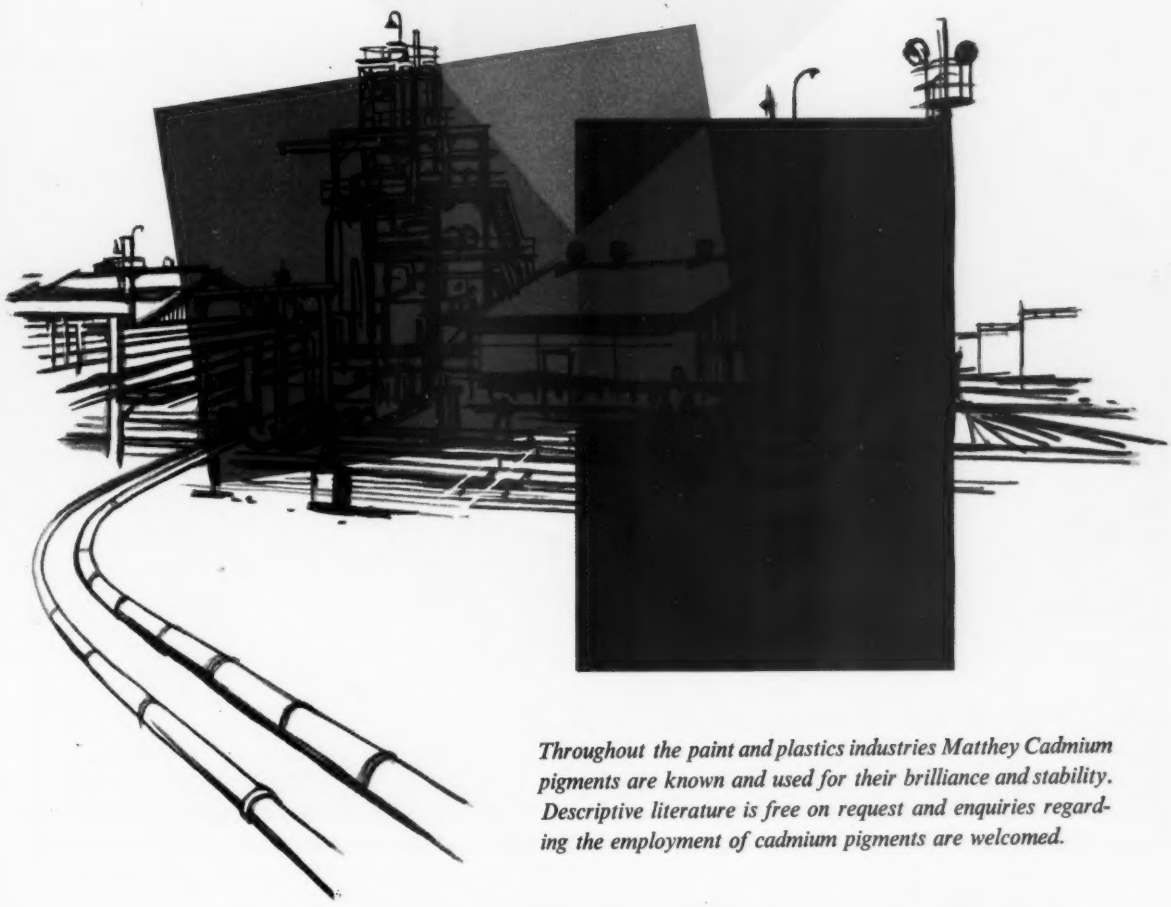

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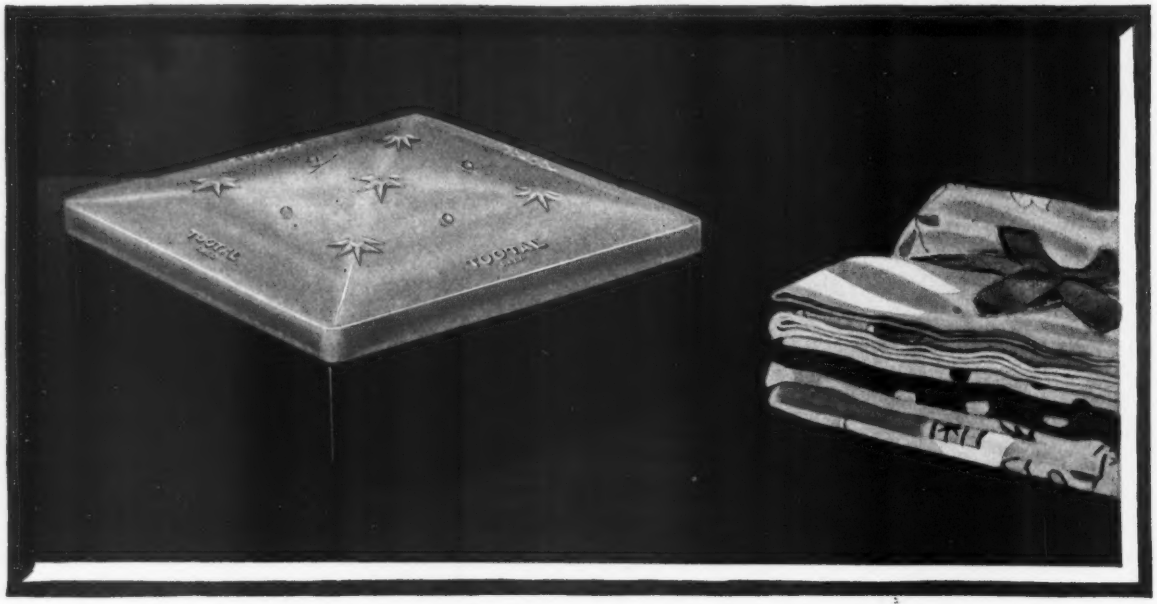

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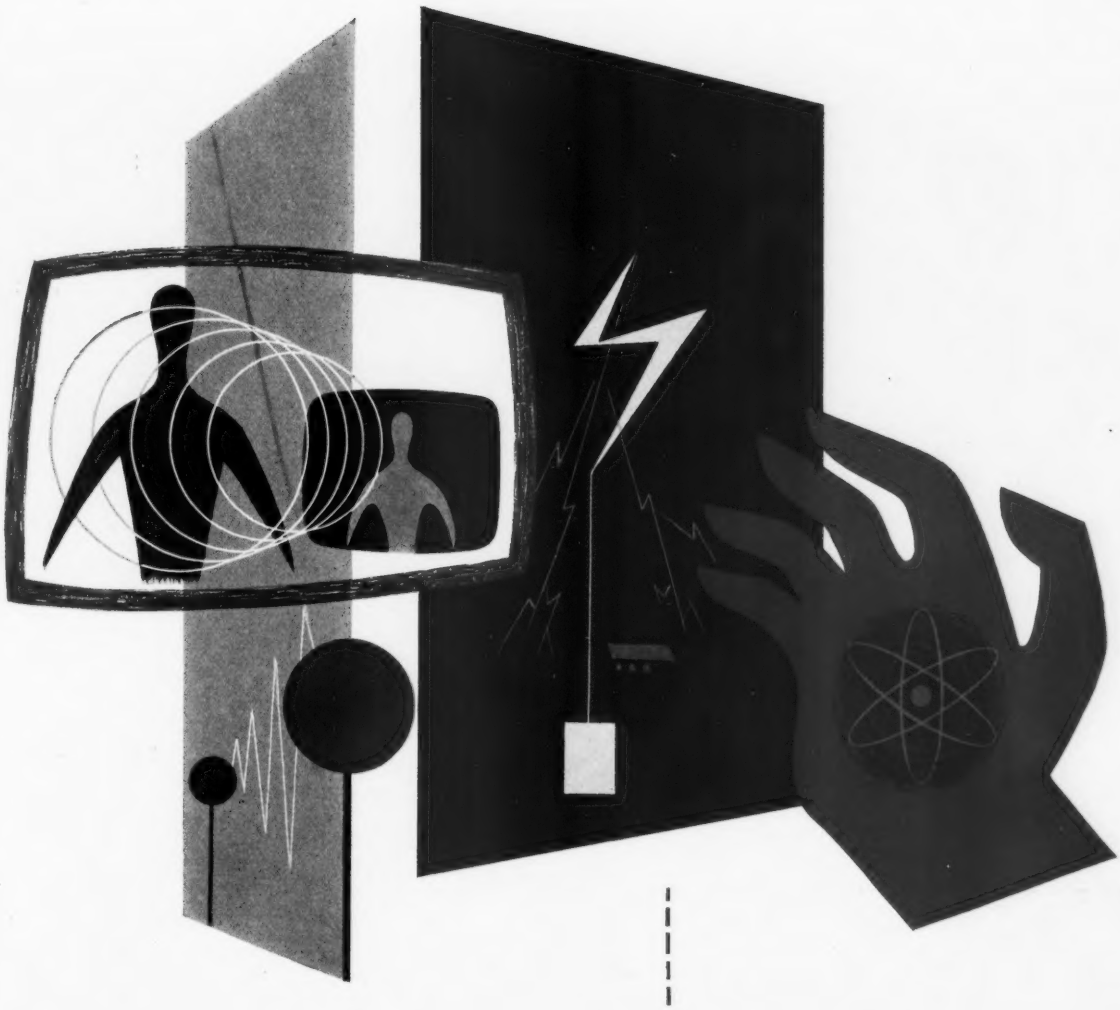

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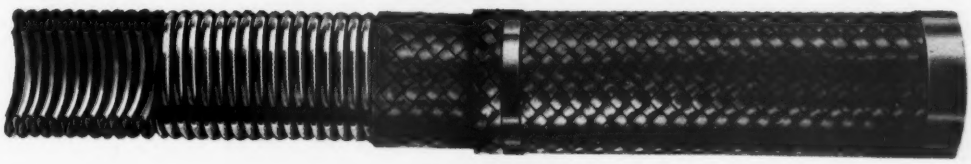

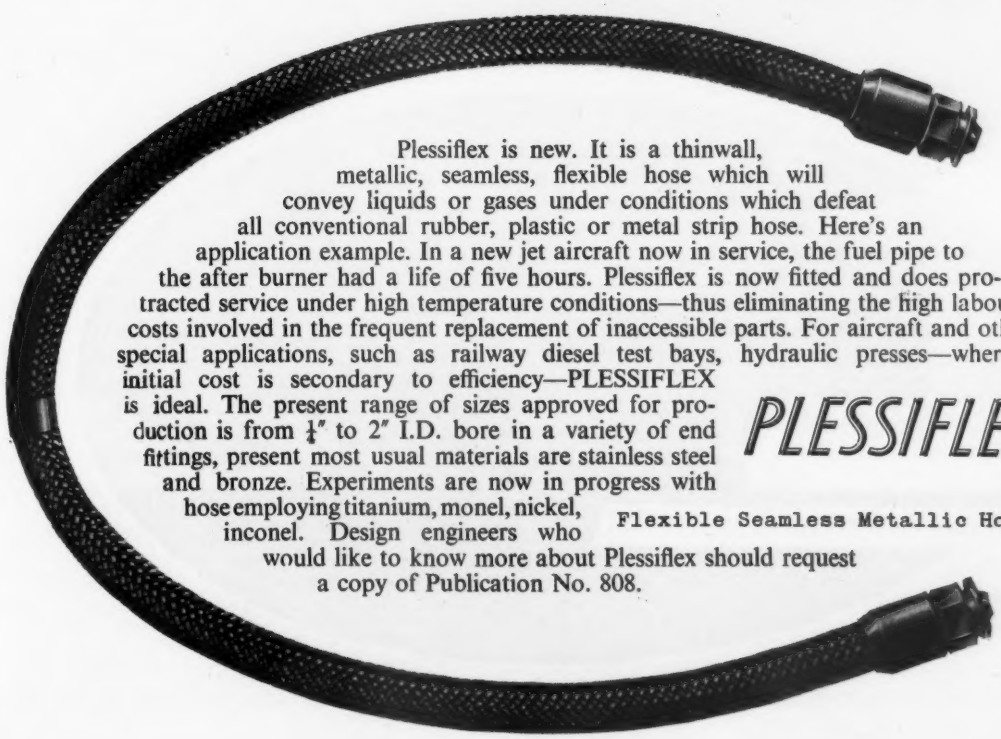

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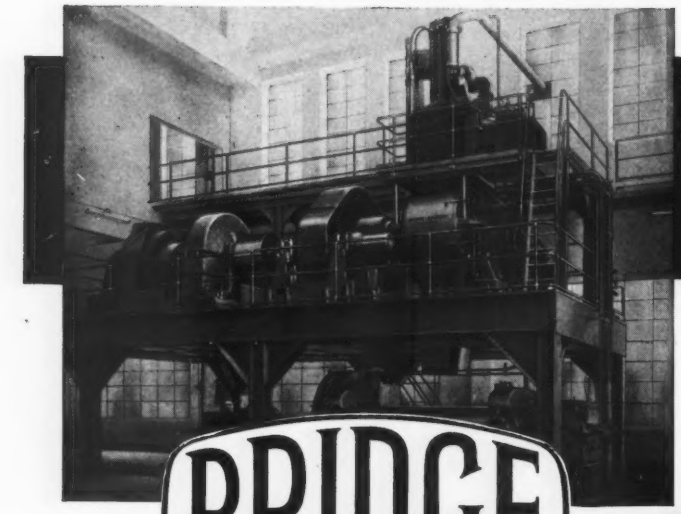

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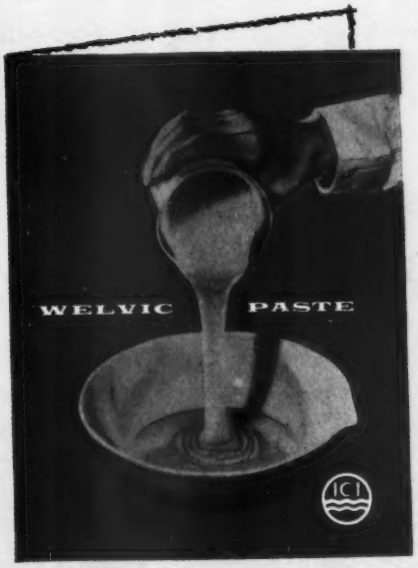

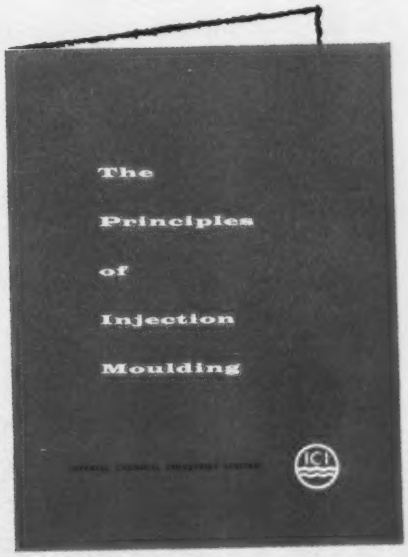

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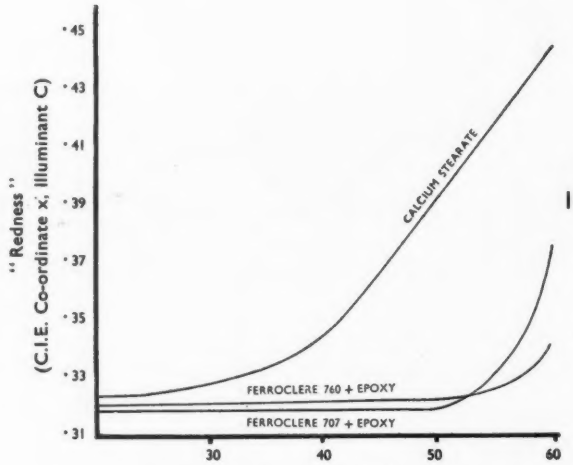

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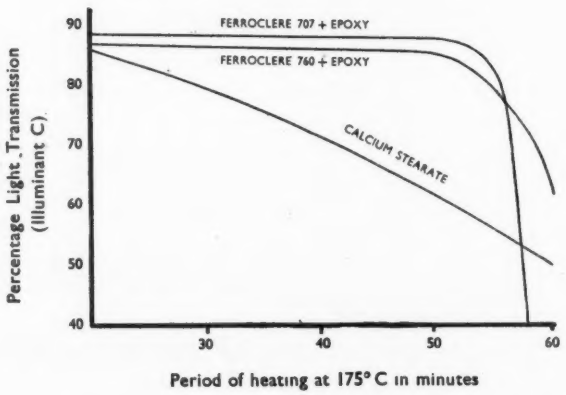

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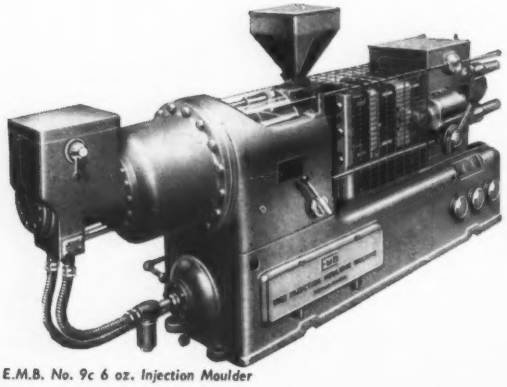

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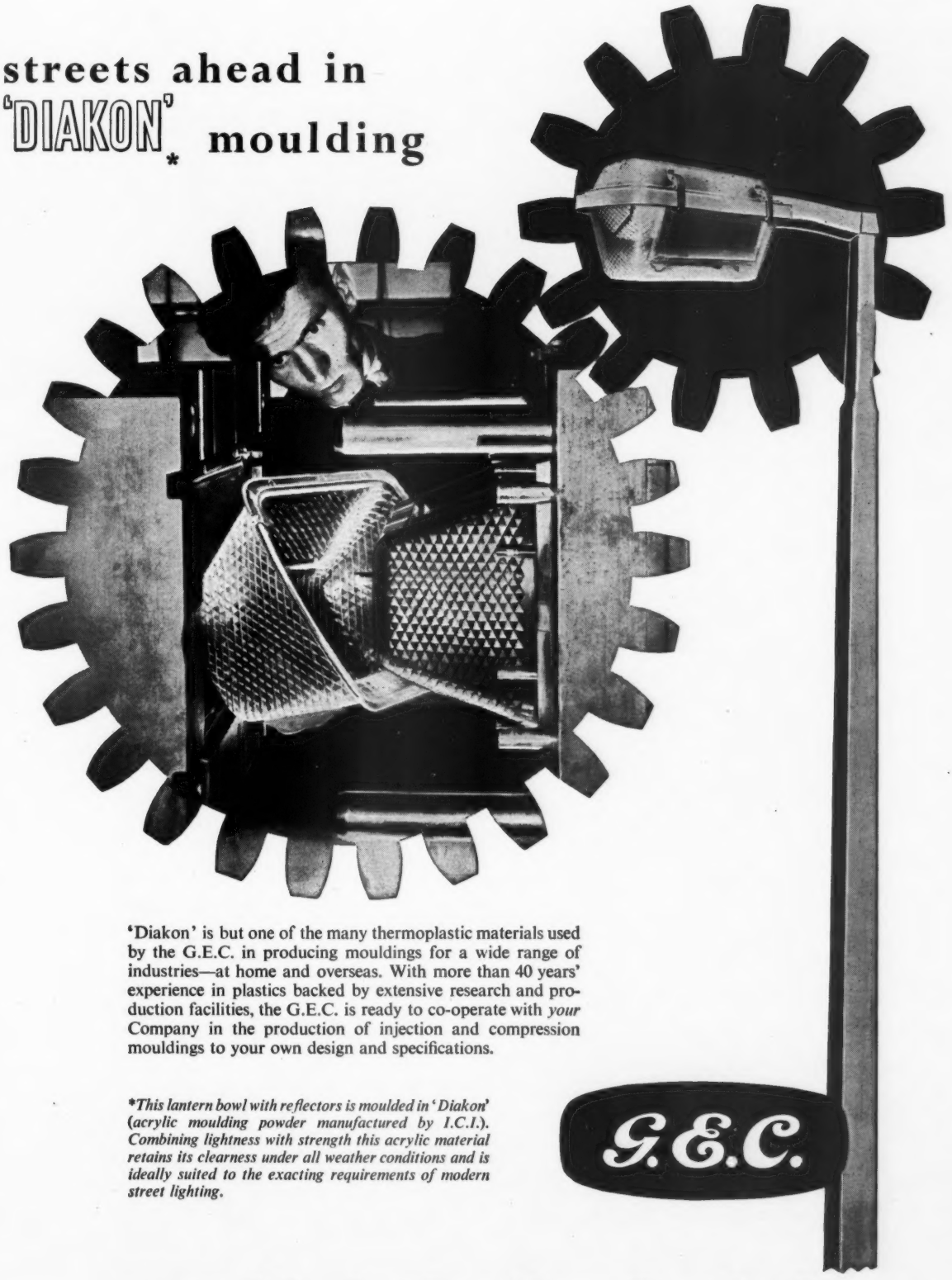

'Diakon' is but one of the many thermoplastic materials used by the G.E.C. in producing mouldings for a wide range of industries—at home and overseas. With more than 40 years' experience in plastics backed by extensive research and production facilities, the G.E.C. is ready to co-operate with *your* Company in the production of injection and compression mouldings to your own design and specifications.

**This lantern bowl with reflectors is moulded in 'Diakon' (acrylic moulding powder manufactured by I.C.I.). Combining lightness with strength this acrylic material retains its clearness under all weather conditions and is ideally suited to the exacting requirements of modern street lighting.*

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P 35

Fitting illustrated
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Eythorne, Dover, Kent

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MANUFACTURERS OF REINFORCED LAMINATES AND MOULDINGS

YOUR REF: GBJ/JFA OUR REF: RS/SU/ML DATE: 24th May, 1956.

Messrs. James Beadel & Co. Ltd.,
110, Cannon Street,
LONDON, E.C.4.

Dear Sirs,

We thank you for your letter of the 23rd May with regard to the question of fire retardant resin and note your remarks with interest. By a remarkable coincidence we have received a letter to-day from a firm of builders' merchants to whom we supplied corrugated translucent sheeting made with your Filabond 1345 Resin, advising us that some of these sheets which were installed in a shop in Weston-Super-Mare were involved in a fire on the premises during Whitsun. The shopkeeper reports that in the fire our "Rufelite" sheeting helped to hold back the spread of flames and he is therefore very keen on the product.

This undoubtedly answers the question of fire resistance which we had been discussing with you and we feel you will agree that one eventuality of this nature is worth a good deal of abstract laboratory investigations.

Yours faithfully,
S.P.Structural Plastics Ltd.

R. Sheridan

Director.

filabond polyesters resins

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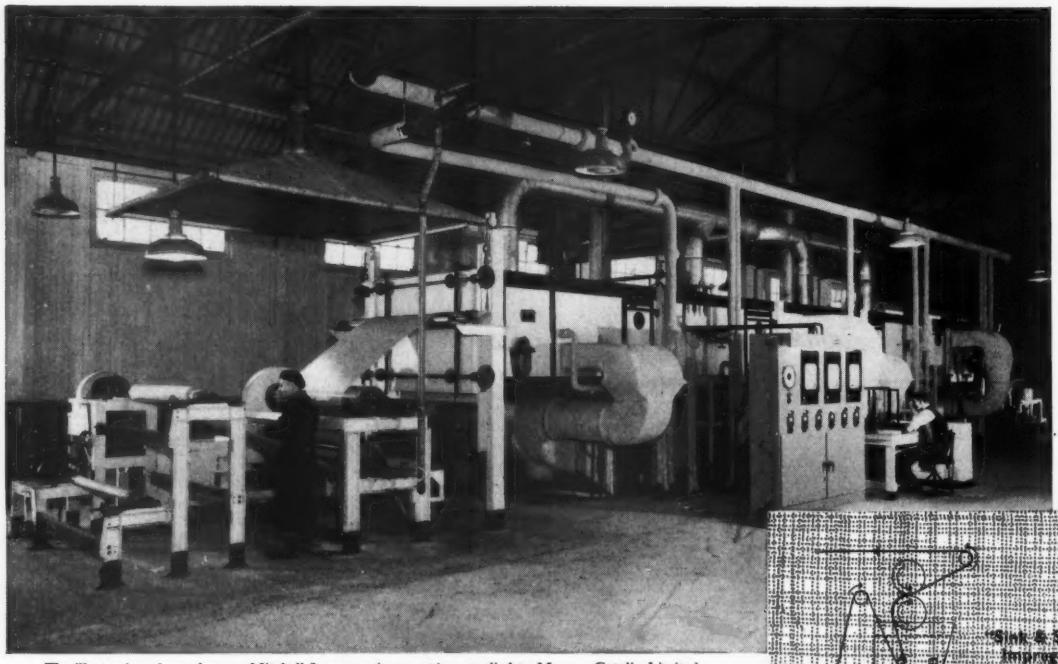
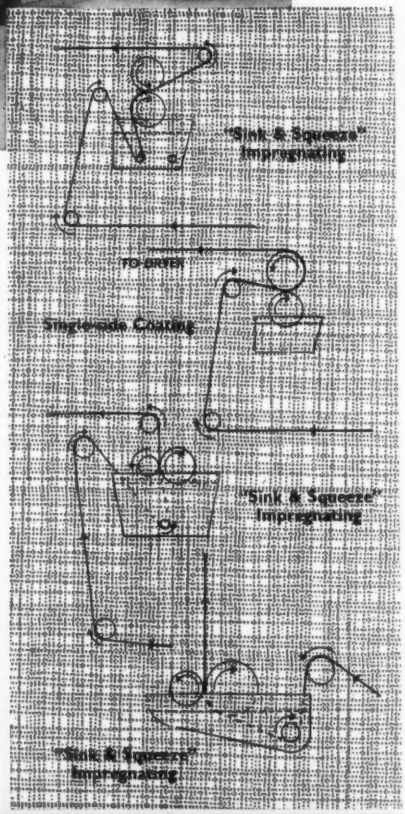


The illustration above shows a Mitchell Impregnating machine supplied to Messrs. Catalin Limited, Waltham Abbey, Essex.



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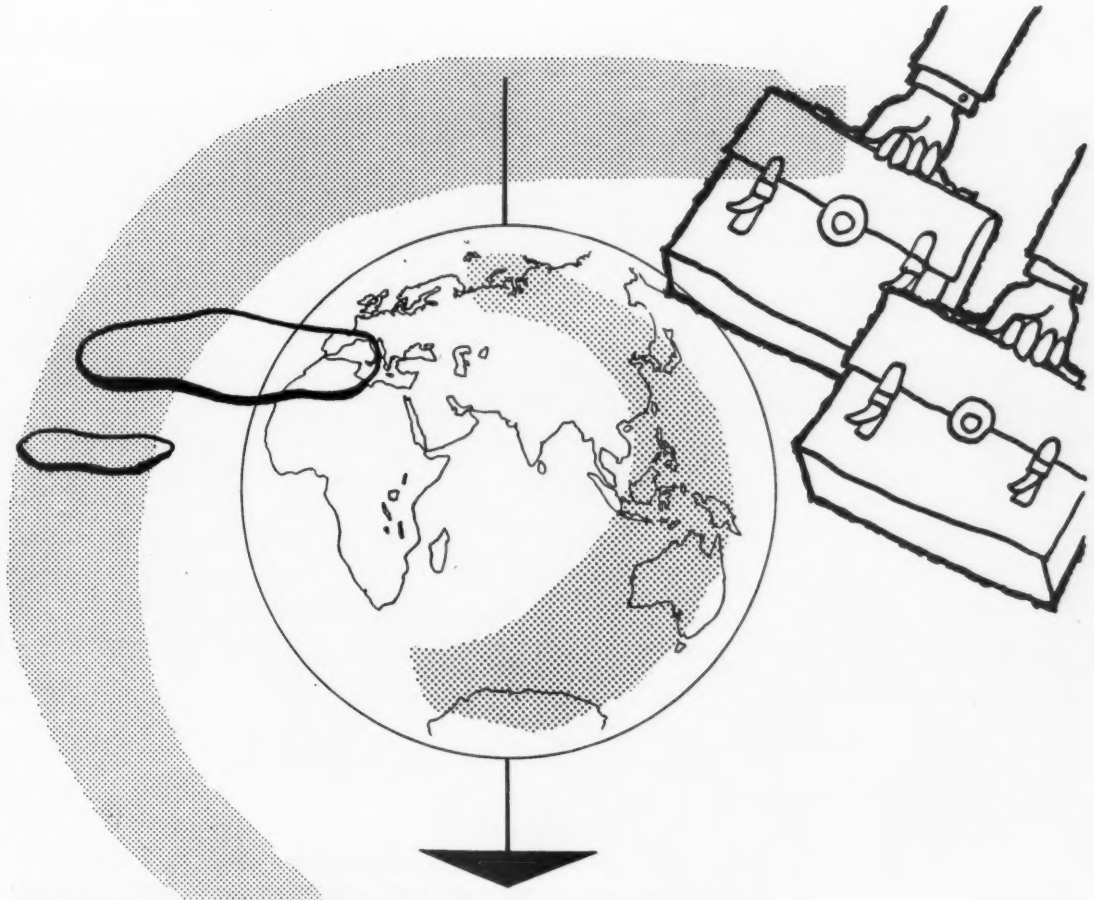

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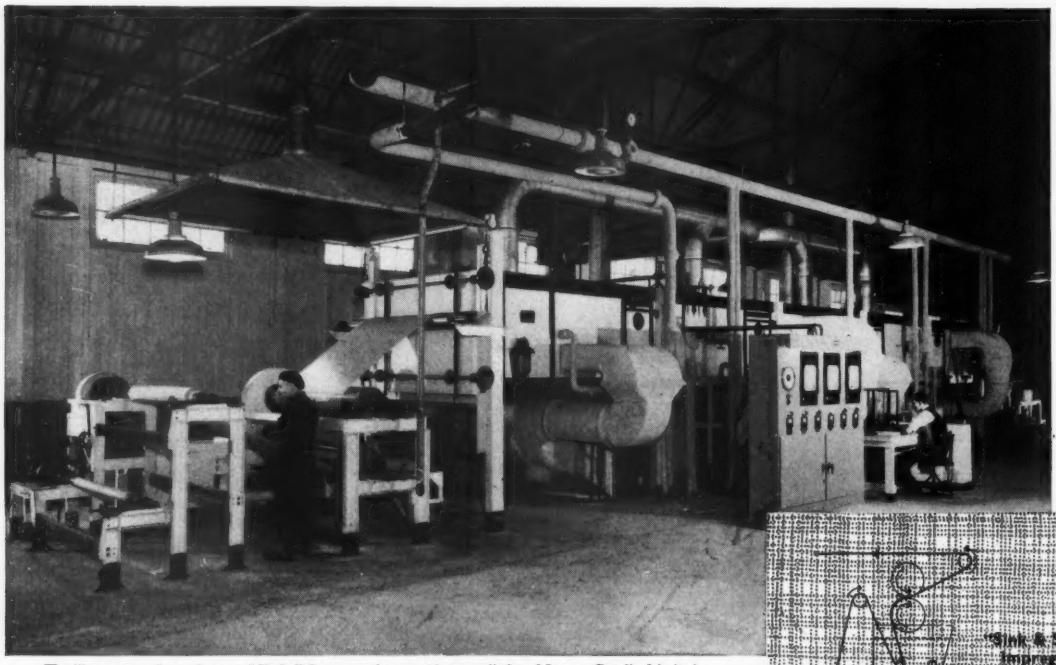

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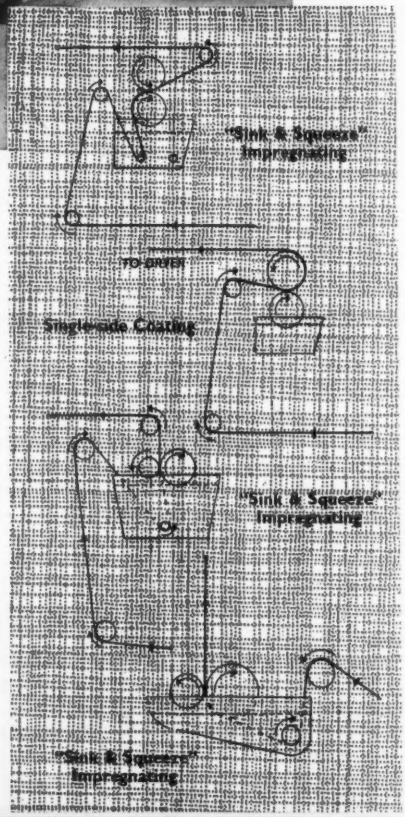

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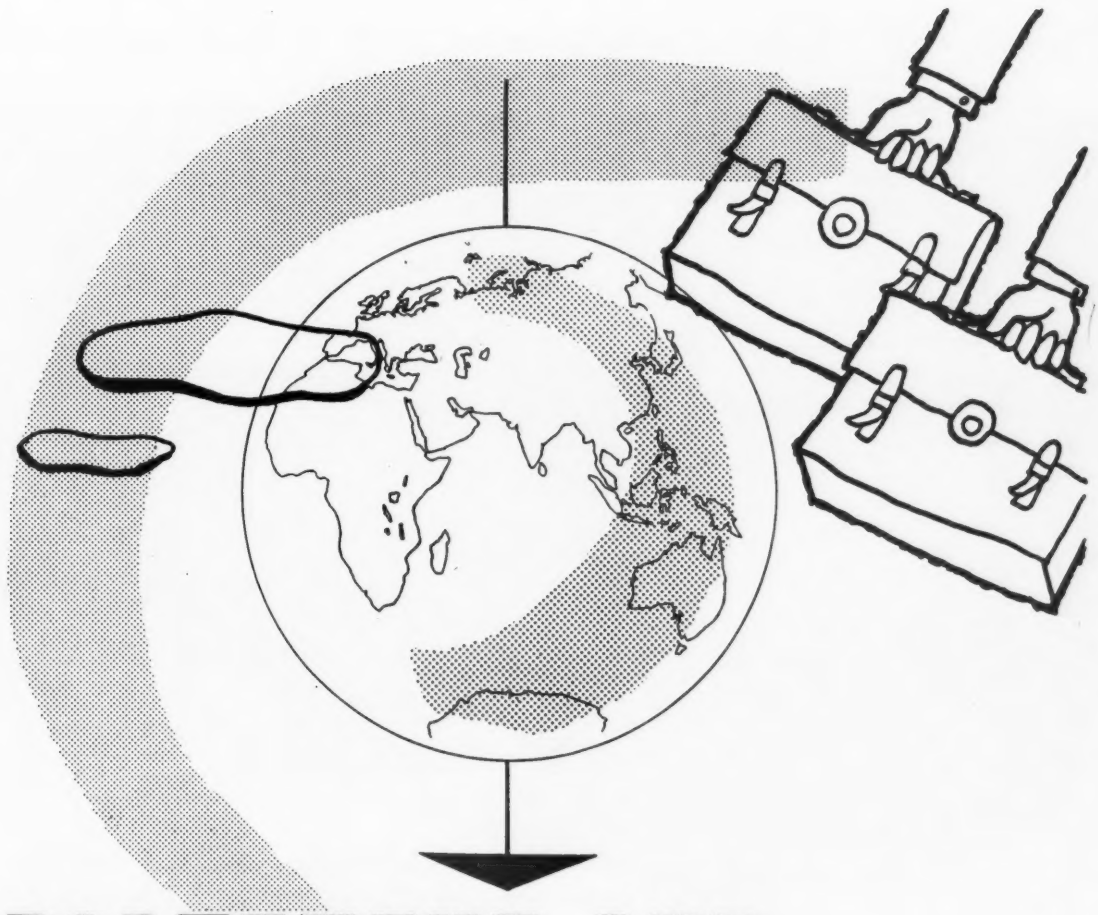

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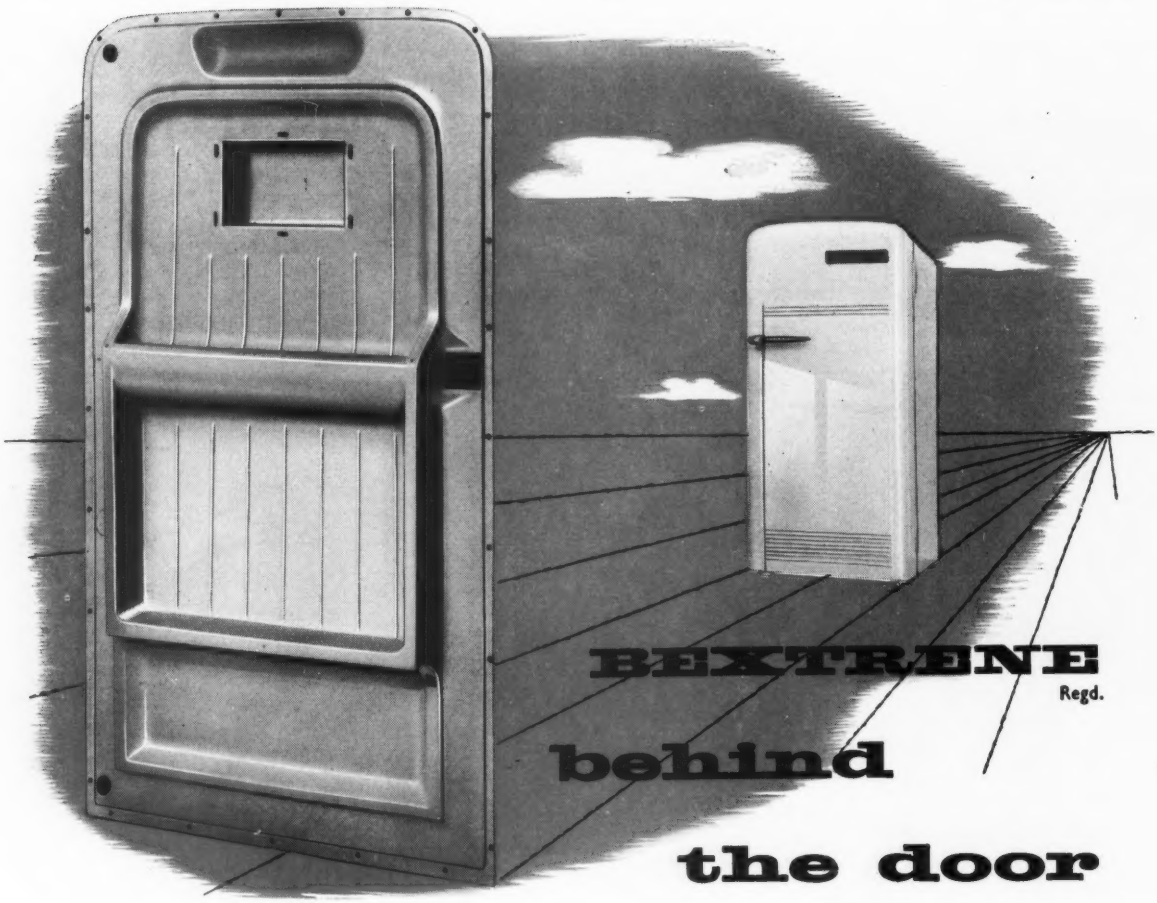

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(Write for a copy of Publication No. 566)

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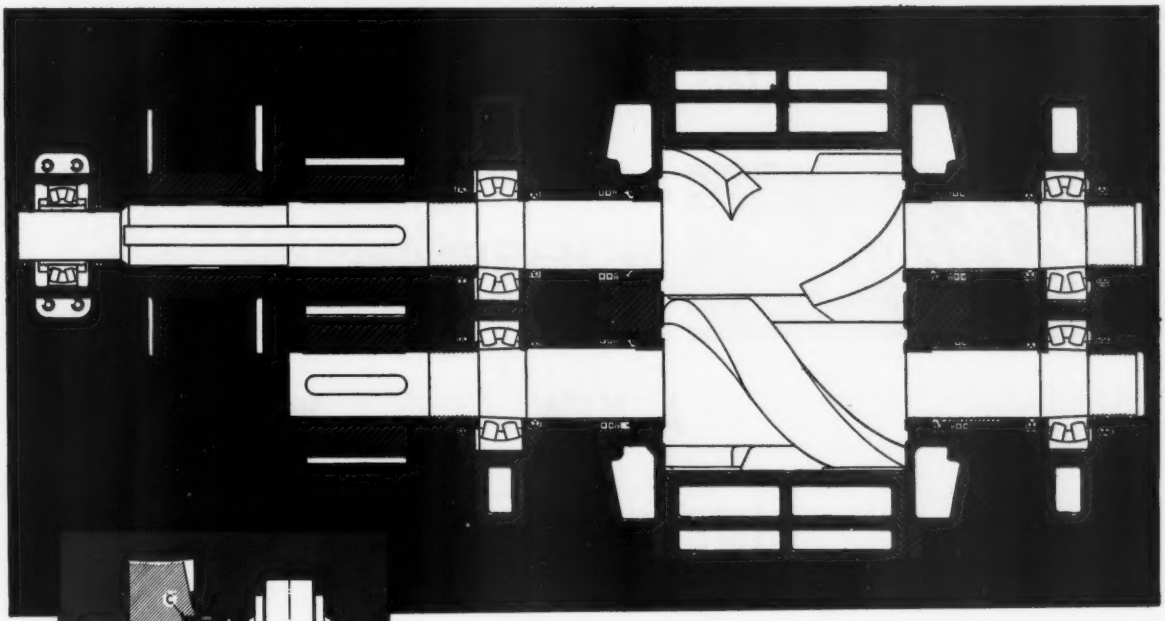

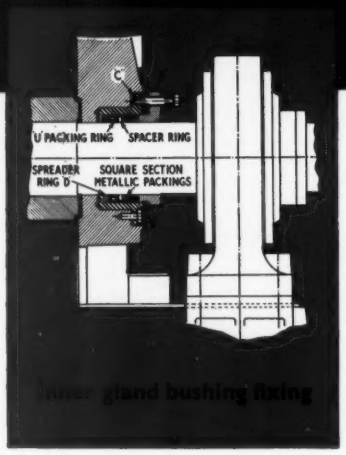

We are telling you now just why the Shaw Intermix has the reputation for mixing to a consistently high standard yet shows signs of little wear after prolonged processing.

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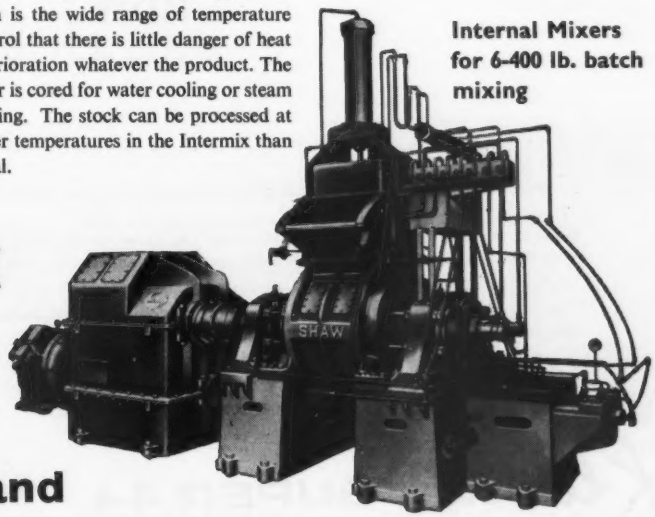

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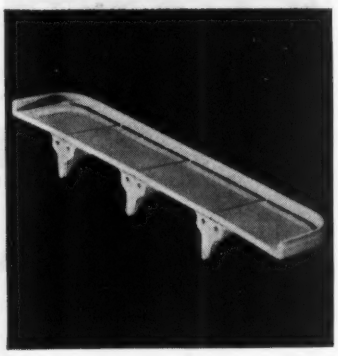
We are confident you will not find a better material.

This material is recommended for battery boxes, radio cabinets, industrial components, expensive toys, housewares and sheet.

It has already been proved suitable on all these applications.

By all means send for a leaflet—but you can't mould leaflets—try this material yourself NOW—and register the impact on your own mouldings.



This 22" bathroom shelf injection-moulded in one piece is an example of the type of product which can be made in SUPER 44.

Kleestron **SUPER 44**

IMPACT STYRENE MOULDING MATERIAL

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This fine baby bath, in pastel pink, is an example of the first-class results now obtainable with Kleestron Impact Styrene Sheeting, the material that has radically cut the cost of "big-piece" moulding.

Kleestron SUPER 44
IMPACT STYRENE SHEETING

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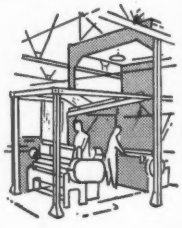

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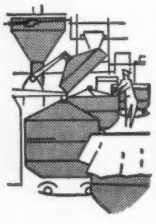

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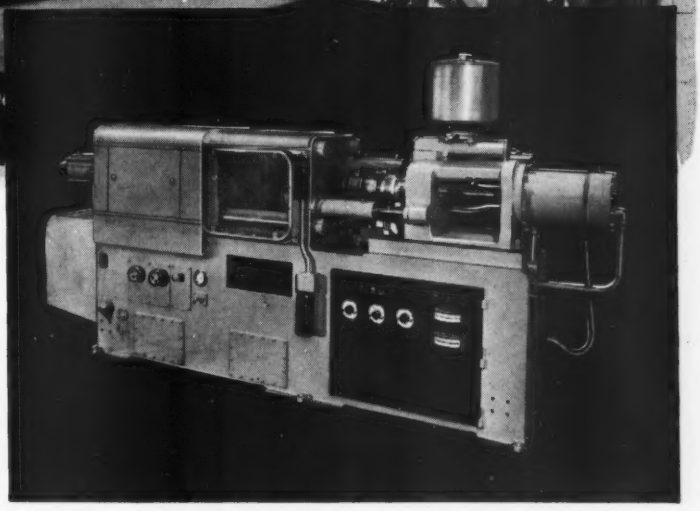

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patents applied for

Pipe and cable haul off
patents applied for

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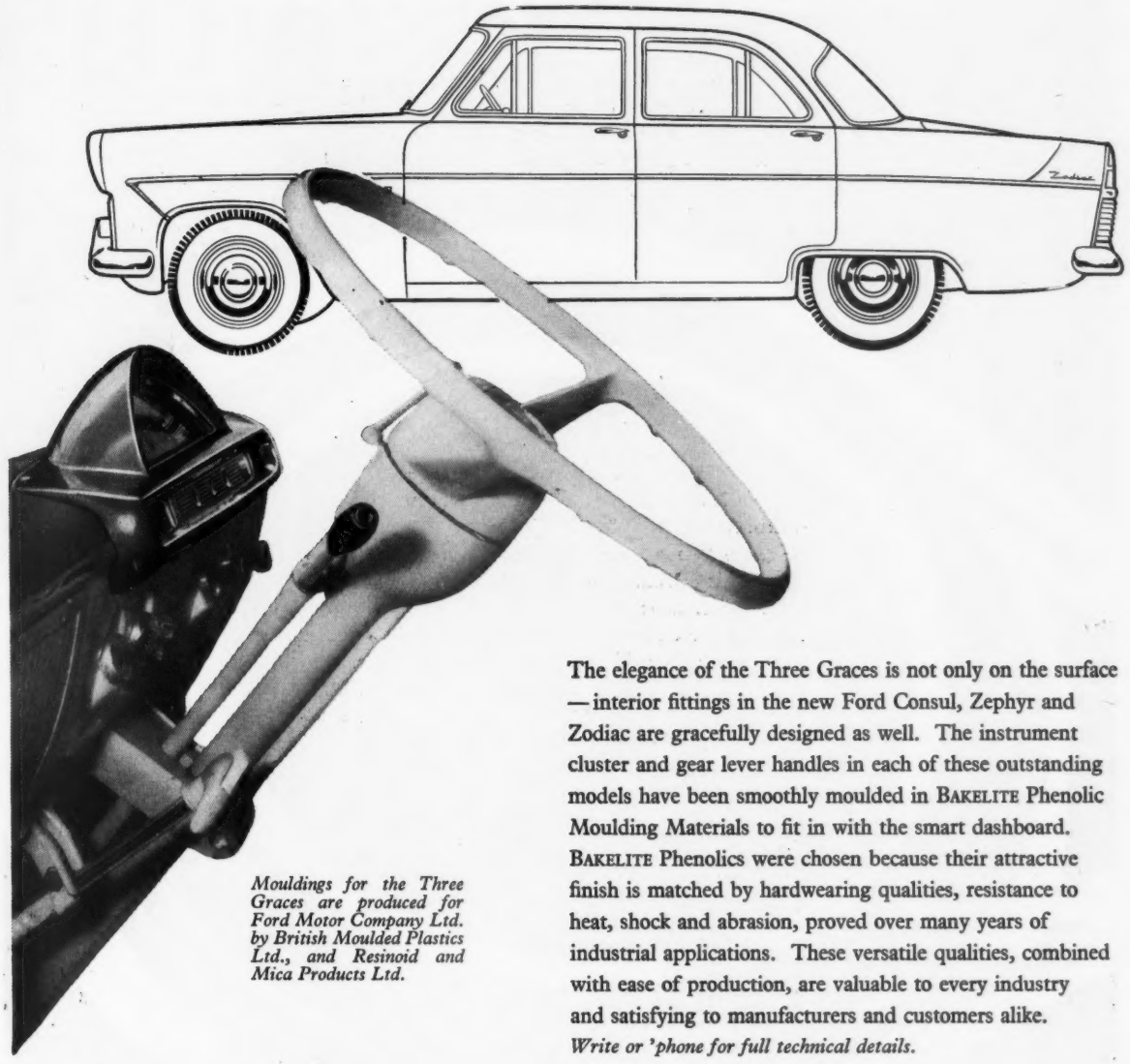
BAKELITE Phenolics
TRADE MARK

to grace the Three Graces



Mouldings for the Three Graces are produced for Ford Motor Company Ltd. by British Moulded Plastics Ltd., and Resinoid and Mica Products Ltd.

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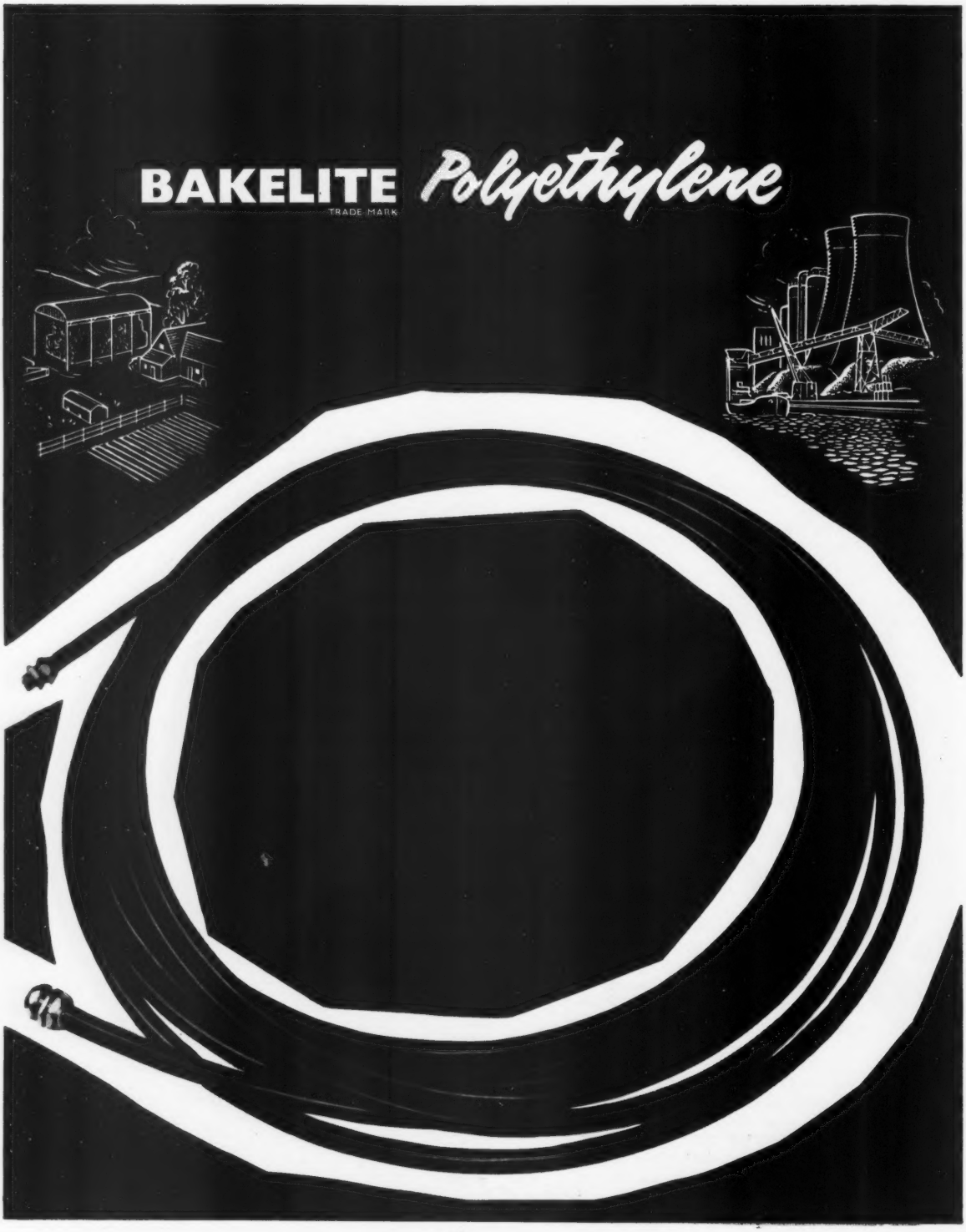
TGA HP4



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Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

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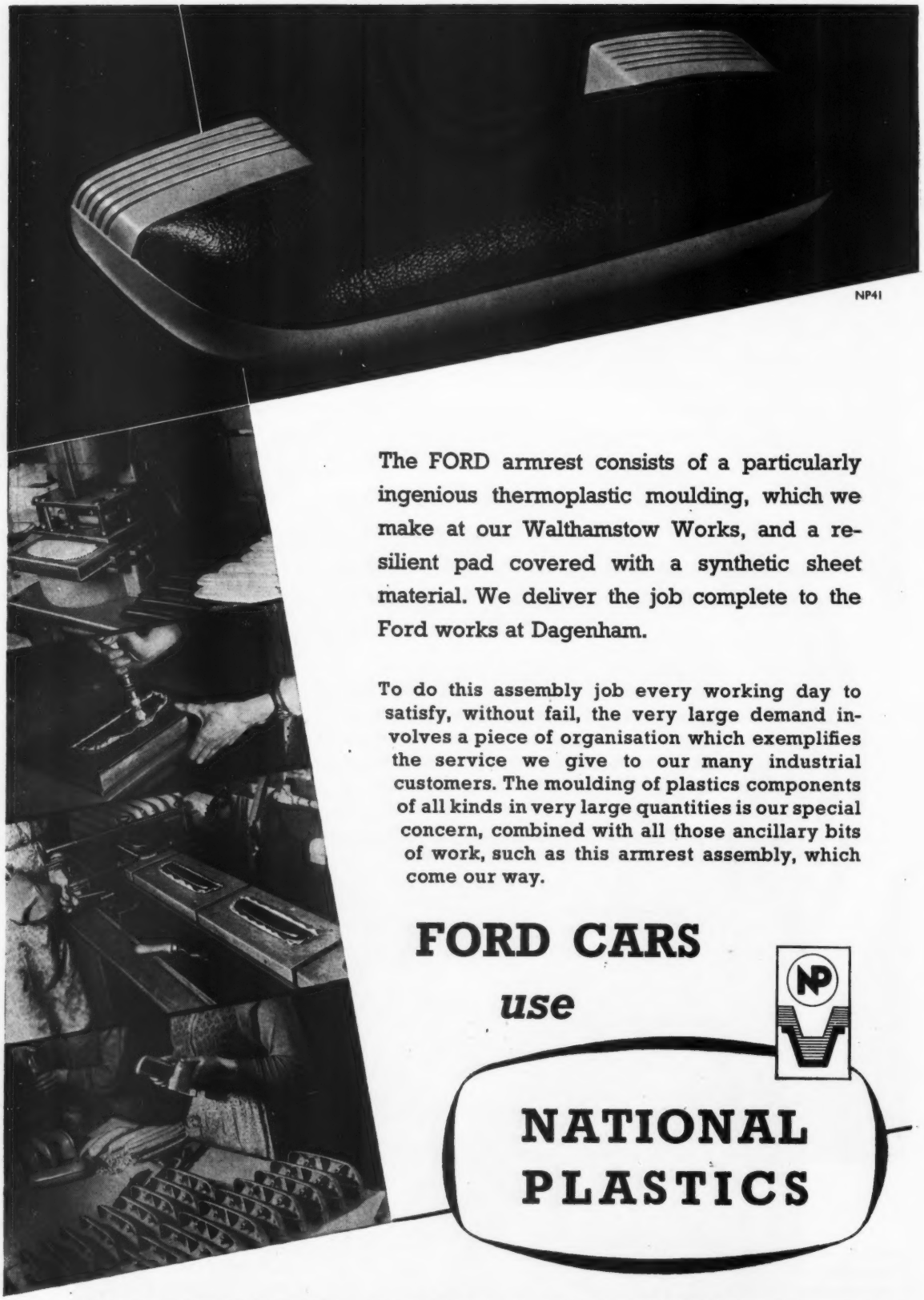
Telephone: TERminus 3636

Unicar production line at the Boreham Wood factory of S. E. Opperman Ltd.



The FORD armrest consists of a particularly ingenious thermoplastic moulding, which we make at our Walthamstow Works, and a resilient pad covered with a synthetic sheet material. We deliver the job complete to the Ford works at Dagenham.

To do this assembly job every working day to satisfy, without fail, the very large demand involves a piece of organisation which exemplifies the service we give to our many industrial customers. The moulding of plastics components of all kinds in very large quantities is our special concern, combined with all those ancillary bits of work, such as this armrest assembly, which come our way.

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Plastics

VOL. XXI No. 230 NOVEMBER, 1956

EDITORIALS

New Industrial Revolution

ON October 17 Queen Elizabeth II inaugurated the world's first full-scale nuclear power station at Calder Hall and the electricity generated therefrom now flows into the national grid system. And since power, electrical power, is the common yardstick by which the nations measure material prosperity we may regard the event as the beginning of a second Industrial Revolution. There is still a vast untracked realm to be explored as a result of this beginning, but of one thing we are sure: every man and woman who can read, believes and feels very deeply that it bears the seed of a great and beneficent future for this country and indeed for the world. We all know that if we have the will to use our energies and press forward in the face of what still must prove difficult times we shall look back upon our first Industrial Revolution, in spite of its 100 years of comparative prosperity and of brilliant production, as a period also of industrial strife that never shook itself free from the filth of its own making.

Just as our first fuel, wood, also produced chemical by-products on combustion until it disappeared as an economic asset, and just as from our coal and now our petroleum we produce chemicals for our great dyestuffs, pharmaceutical, fertilizer, synthetic fibre, plastics, textile and metal industries, so also is there a new flow of by-products from the nuclear reactors—the radio-active isotopes, whose use in medical and chemical research and in many branches of industry has already astonished the world.

So far as our own industry is concerned a beginning has been made by a number of large firms in the use of Van de Graaff accelerators which can produce electrons, positive ions, gamma rays and neutrons at will, or in the use of radio-active isotopes.

Over two years ago we published the results of work carried out at Harwell on the effect of high energy radiation on certain plastics; in the case of polythene the radiation effected a cross-linking of the polymer thus virtually producing a relatively thermosetting resin from a thermoplastic one. Today this work is being continued at the irradiation laboratories of British Insulated Callender's Cables, Ltd., where the high energy produced from one of the aforesaid machines is used to modify the structure and properties of conventional polythenes used as cable insulants, and it has been found that such cables can be treated continuously to produce high softening temperatures among other advantages. T.I. Plastics, Ltd., has also carried out similar work on polythene irradiated in the electron beam produced from a Van de Graaff and has already placed on the market a polythene tape with improved properties.

Monsanto Chemicals, Ltd., as we announced recently, has installed plant for general research work on chemical reactions initiated by the radiations emitted by the isotope Cobalt 60. Work such as this may have very wide repercussions for not only may it give us much more knowledge of the method of formation of polymers but facilitate also their production in much greater purity and with enhanced properties.

Beyond this there lies the possibility of advances in all ancillary processes—in the engineering side of our industry, in measuring metal plating processes, in reducing fires, in gauging liquid-containing tanks, in controlling solvent levels, in detecting metal intrusions, in quantitative measurement of powder mixes, the solving of most lubricating problems in the widest sense and so on. Never before has the imagination been stirred at these new possibilities and never before has industry been made so much aware of the fact that herein lies our future.

Pipe Jointing

NO sooner had we written and published last month our editorial on " Plastic Tubes and Pipes " and had referred to the obvious problem of providing connections and jointings generally, than we were invited to an exhibition to see the new I.C.I. " Alkalite " fittings for polythene pipes.

The dfficulty of securing jointing of plastic piping carrying liquids to guarantee absence of leaking has been obvious. Those of cellulose acetate or aceto-butyrate are treated with solvents of the acetone, amyl acetate, and benzene type and the nylons and polyurethanes with phenol or formaldehyde in which they are soluble. Neither of these methods at first sight appears very attractive since softening thus achieved, followed by pressure would seem to create the possibility of diminishing the diameter at the point of jointing.

With polyvinyl chloride there is the possibility of high frequency welding and heat welding, but polythene can only be welded by heat. Separate junctions are made by injection moulding; one which, it is claimed, can be employed without welding has already been described in this journal (November, 1955 issue, page 388).

The most recent type was that seen at the I.C.I. exhibition noted above. The " Alkalite " fittings, which are injection moulded make possible for the first time an all polythene plumbing system. During the manufacture, two metal rings of resistance strip forming a small heating element, are moulded into each socket of the fitting. Two leads from this element project from the end of the fitting as electrical connections. Through these, current is supplied from a heavy duty battery so that both fitting and tube are heated locally and complete welding takes place. As a means of training unskilled personnel in the technique, I.C.I. are making available a timer which can be preset for making joints of different sizes and takes account of the varying state of charge of batteries.

Point of New Departure

IT has often been said that the plastics industry owes a tremendous debt to its sister industry, synthetic fibres. Certainly it is a fact that Bevan, Cross, Beadle, Carothers and Whinfield, and many other chemists, established a classical pattern of research in high polymers, in their investigation on viscose and acetate rayon, the superpolyamides, and the polyesters. From the vast reservoir of knowledge concerning fibre-forming polymers has been drawn much of the information the plastics industry has required in the evaluation of materials, and in investigating the possibilities of new materials. This has been specially important in the matter of basic theory; for example, the phenomena of molecular orientation, coupled with marked increase in tensile strength, is fundamental to the synthetic fibre industry, and we have been able to make use of it in many other important directions.

When, therefore, we first heard of a film that was in course of production, dealing with Terylene, the polyester fibre, we hoped that in some measure it would serve to mark the commonalty of interest between plastics and fibres. Little did we dream that apart from achieving this, the producers had also made J. R. Whinfield himself the sole participant in the film. Now, preserved for the generations of students to come, is a magnificent documentary record of Whinfield, in his laboratory, taking us step by step through the important stages of his years of research, to culminate in the successful launching of Terylene.

Dr. Whinfield was born in 1901 in Surrey, and worked closely as a young man with C. F. Cross who had, in 1894, discovered viscose rayon. It was from Cross that he derived his deep and abiding interest in synthetic fibres. When Carothers announced in 1935, success with nylon, many lesser men than Whinfield might have given up the search for a new fibre-forming polymer. The fact that he pressed on is characteristic of the man, and it was when he was with the Calico Printers Association in 1942, that he was able to say that his own research programme had yielded an entirely new fibre.

In this film, " Point of New Departure," we see Whinfield in his laboratory at the Fibres Division of I.C.I. Ltd., where he is a director. With the skill a professional actor might envy, he describes the pattern of research that preceded Terylene, and amplifies his words with demonstrations and by the use of molecular models. As a record of one of Britain's outstanding scientists, as a documentary film, and as an object lesson on the close identity of fibres and plastics, "Point of New Departure" must be applauded as a remarkable achievement.

Moulding Powder and Shot

Kill That Rust!

As a side light on the business of metal protection, it is extraordinary how thoughtless we are over the so-called little things of industrial life that can turn out to be important. Heaven alone knows that the modern works manager has enough on his plate these days: " Where on earth am I going to store the thousand gross of cardboard containers," " Joe on the 16-ouncer is away with a belly-ache and won't be back until pay-day," " somebody's quoted fourpence a gross less on that billion order " and the hundred and one other worries. But what I mean is that I have never seen much thought or energy spent on keeping iron or steel from rusting and this goes for a good many tool rooms too. As a good example of thoughtlessness, I was round a more or less completely new factory some months ago where they were producing lovely light coloured beautifully made units, but somebody had been too lazy or too stingy to treat the overhead iron piping with any sort of protection. As a result (it was in a district where moisture condensation is pretty heavy, as it is almost everywhere in this country) there was a gentle fine rain of red rust particles drifting from the heavens above and settling on the articles ready for dispatch. And yet spending an hour or two spraying with an " invisible " film of one of those new anti-rust preparations, which I understand contains some kind of permanently fluid yet adherent " plastic," all this " dirt " could be prevented.

* * *

G-Granpa kicks the Bucket

Reporting on David Radford's admirable paper " Polythene in the Home," read before the British Plastics Federation Conference at Torquay last month, Auntie Hetty tells us in the Woman's Page of the *Daily Telegraph* of October 10 that the wonderful polythene wash-bowls will be passed on to future generations as heirlooms . . . Launcelot Dogsboddy, 3rd Earl of Bowling Green, holds the polythene bucket gently between his hands and passes his sensitive fingers over the age-old surface. " This, son," he says to young Homer, Viscount London, E.C.1, " was made by your great-grandpappy for your great-grandma way back in the old pioneer days in 1957 " . . . (Note: England in 2065 is an American colony brutally governed by the licentious far-western imperialists under King Chi' Tribune III who has forced their language on the helpless aborigines) . . . The Earl turns it bottom-up and his eyes glisten with unshed tears. " There," he says, " you can still see his signature, an X, and here is the intertwined B.S. the hall-mark of British quality in them thar days. They say as how he used a 40 oz. hand-operated injection machine for the job. He wore hisself out the ole man did, turning the ole wheel in the ole yard back of the ole castle . . . They cairn't make 'em like that now. An' there ain't no polythene now neither—only polyundecylene: hard as brick, no warmth about it and made direct from stinking gas by shoving it in a nooclear reactor. Pah! Who 'ud leave a polyundecylene bucket to his son?. . . This is your wedding day, Homer my boy, so take it and cherish it." Shakes his head sorrowfully and . . . " Naw, they doan't make 'em like that no more this-away." Breaks down and sobs. Viscount breaks down and sobs also. And you won't believe it, but in comes the Countess and she too, breaks down and sobs.

* * *

German Exhibits in London

What must be the first exhibition of German plastics ever shown in this country was seen at Park Lane House, on October 22–26. It had been organized by R. H. Cole & Co., Ltd., in conjunction with J. M. Steel & Co. Ltd.; the former are sole agents for raw materials and the latter for surface coatings, for materials manufactured by Farbenfabriken Bayer A.G. of Leverkusen, Germany.

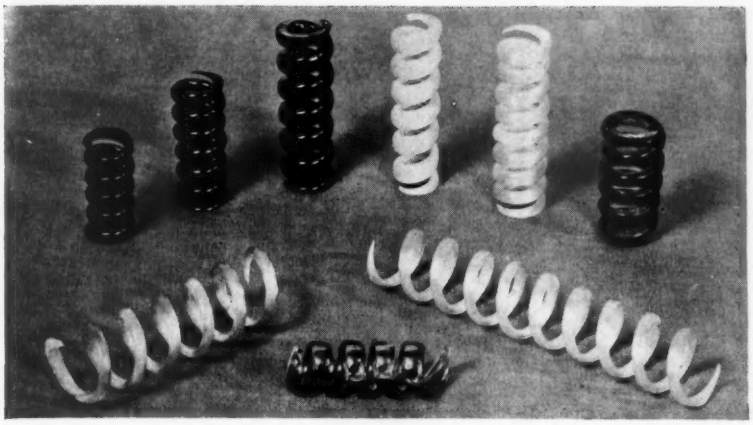
Three types of plastics were exhibited, cellulosics, including cellulose aceto-butyrate, polyurethanes, and caprolactam nylon 6, but so numerous were the specimens of their applications shown that they filled the stands in a very large hall. The cellulose aceto-butyrate, which we believe is the only one made in Europe, was shown in the form of cast rods (some of which were of considerable diameters) and tubes and a very wide range of mouldings. This material is rarely employed in this country although as tool handles, injection-moulded or machined from rod, it is quite well known. The polyurethanes, made from di-alcohols and di-isocyanates, are offered under the trade name Durethane U, in three grades. Low moisture absorption is a special feature of the polyurethanes, coupled with transparency to light if required. Such is the versatility of this group of compounds that they have been employed for injection moulding (bearings, gears, telephone hand-sets etc.), cable coverings, blown foils, tapes, and blown bottles. A very impressive range of products had been gathered together for the exhibition.

To the British observer, the polyurethanes were probably the most interesting of the materials shown, partly because they had hitherto only been seen in this country in the form of foamed products, and partly because of their obvious ubiquity of application. However, the range of nylon mouldings showed that in Germany no limitation has been set on applications, thus avoiding the bias in Great Britain towards the use of nylon for technical purposes. Amongst the applications shown were packaging foils, door handles, and vacuum cleaner parts.

The expert statisticians are always fond of telling us how low down in the scale is our " per capita " use of plastics. This is very distressing but we should remember that this country has probably always been the world's greatest producer (per capita) of all other basic materials especially metals. Germany, and many other countries with less facilities, and the pressure of using home-produced raw materials under the Hitler regime, turned to plastics with growing understanding.

If it is any consolation, we believe that we shall see a much increased rate of use in this country of plastics as and when the new materials and new uses are in production and purchasing becomes freer.

DOGSBODDY.



Resin / Glass Springs

A report on development work in America, carried out by the National Bureau of Standards and the Army Ordnance Corps

By J. C. ADAMS

INFORMATION has recently been released in America on a practical procedure for mass-producing plastic springs which has been developed by the National Bureau of Standards in work sponsored by the Army Ordnance Corps. Springs formed in this way from glass fibre-reinforced resin have desirable mechanical properties for a wide range of applications. Until now plastic springs have been little used because suitable techniques for making springs of the types needed have been lacking.

Polymeric materials, of course, have a number of inherent advantages for use in springs for special purposes. Thus, they are non-magnetic and have low electrical and thermal conductivities. They can be moulded directly to accurate dimensions without the development of any appreciable internal stress. Their high corrosion resistance makes them of value for applications in chemical plants and installations subject to acid fumes or to salt air. Other applications may benefit from the strength-to-weight ratios of plastics, which are often higher than those obtained with metals used for making springs. In addition, the broad range of transparent and coloured materials that can be used make striking decorative effects possible.

The plastic springs are moulded by drawing resin-soaked glass fibres through vinyl copolymer tubing and wrapping the loaded tubing in a helix around a mandrel. After curing in an air-circulating oven, the tubing is removed, leaving a solid plastic spring reinforced with glass fibres.

The most successful procedure to date uses vinyl chloride-vinyl acetate copolymer tubing having a $\frac{1}{4}$ or $\frac{3}{16}$ in. inside diameter and a $\frac{1}{8}$ in. wall thickness. Lengths of glass rovings are formed into a loose yarn, without twist, which is then doubled back to make a U-shaped bundle. This bundle is placed in a trough partly filled with liquid resin and is immersed until thoroughly soaked. A steel wire is then threaded through the tubing, attached to the bend in the U-shaped bundle, and used to pull the bundle through the tubing. Considerable force is applied to the wire by means of a small windlass.

When the tubing is completely filled, the wire is disconnected and the ends of the tubing sealed with hose clamps. The tubing is wound on a mandrel and the entire assembly is placed in an oven for curing under the conditions specified by the resin manufacturer. After removal of the tubing, post curing is performed as required, and the springs are cut and ground to the finished length.

Of the resins studied, the most promising were epoxides and polyesters. These resins are better suited for spring applications on the basis of torsional moduli, temperature sensitivity, and ease of handling. In general, the polyesters are more sensitive to elevated temperatures than the epoxy resins, but the epoxy materials vary widely in this respect.

Springs made from polyester resins with glass fibre reinforcement showed good energy recovery properties after short periods of storage at —40° F., but these properties were adversely

Fig. 2. A " rope " of glass fibres is dipped in a resin solution.

Fig. 3. The resin-coated glass fibre is drawn into the plastic tubing.

Fig. 4. The tubing is wound round a mandrel to form a helix.

affected by 13 days' exposure to 135° F. while under stress. The best results were obtained with an epoxy resin cured with *m*-phenylenediamine. Springs made of this material possessed torsional moduli of rigidity of the order of $1 \cdot 0 \times 10^{6}$ lb./sq. in. In 2in. lengths they deflected ½ in. under a static load of 25 lb. Three-inch springs of this type retained 40% of their original energy when compressed to their solid length and stored at 135° F. for 13 days.

When the glass-epoxy springs were tested for recoverable energy a second time, higher values were invariably obtained. This characteristic "work tempering" of the epoxide resins was also demonstrated in torsion tests on non-reinforced plastic rods. An improvement of as much as 120% over the original available energy was indicated. Preloading the epoxide spring during storage or within 30 days before use would make it possible to utilize this property of the material.

The mechanical and thermal properties of the plastic springs can be varied widely by proper choice of materials and dimensions. For example, stiffer and probably more brittle springs result when the glass content is increased. At the same time a high degree of homogeneity in static properties can be achieved. Under a load of 25 lb., 100 of the epoxy-resin springs had an average deflection of 0·53 in. with a standard deviation of 0·05 in.

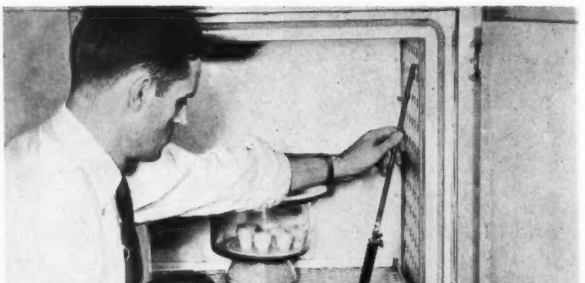


Fig. 5. The mandrel and helix are placed in an oven for curing.

Education Conference

The Plastics Institute held a one-day conference at the Borough Polytechnic on October 26. The following is an account of the address given by Sir Harold Roxbee Cox

THE Education Conference of the Plastics Institute this year got off to an invigorating start with an address by Sir Harold Roxbee Cox. Though his theme was described as "Technological Awards," he ranged more widely over the subject of the national shortage of applied scientists and set in context, as it were, the deliberations of the conference. He several times emphasized that he was speaking in a personal capacity rather than as Vice-Chairman of the Council for Technological Awards, better known as the "Hives Committee," but this caution was perhaps unnecessary. It is most unusual for official pronouncements to be made in such a stimulating and forthright manner.

At this stage of the national debate on scientific manpower, Sir Harold did not present any new facts or arguments, but he impressed rather by the vigour of his conviction that we must perform prodigious feats in technological education if we are to meet the challenge of the future. His view is best summarized in his own words: "Whatever we do in the immediate future will not be enough." It is good to know that some people at least, in high places, feel so strongly on this matter. For even now, at the dawn of the era of atomic power, when the rivalry and conflict of the powers are expressed in the race for technological leadership there are still those who discount the vital and ever-expanding role of science and technology in modern civilization.

Sir Harold was also impatient with those people who try to shrug off the increasing disparity between our resources of technological manpower and those of the U.S.A. and particularly of the U.S.S.R. Comparisons of standards in the technical institutes of the three countries is a difficult business, but is in any event irrelevant, in view of the very large numbers of trained people that are being turned out in the United States and the Soviet Union. It is not the case that nationally we are not so bright as other countries. To the amusement of the conference, the speaker claimed that he had recently invented an index for measuring brainpower and fertility in research ideas. This showed conclusively that we can stand comparison with any nation. We have no doubt that this index is as valid and useful as some of the more fashionable intelligence quotients. Our current problem, however, is to produce the men who will "convert the ideas into hardware."

How then are we to reinforce the forward detachments of our technologically advancing society ? Where shall we find the human raw material for the increased numbers required ? Sir Harold made some suggestions. At the moment there is in the sixth forms at the grammar schools a roughly equal division of students between the sciences and the so-called humanities. The balance is not correct. Greek and Latin, history and law, are very proper and useful studies, foundations of our culture; but times change and the relative importance of these subjects must be reassessed. In any case the fact, for example, that only 30% of those called to the bar ever practise, represents an indefensible waste of trained minds.

At an even earlier educational stage the concept of the "eleven plus" examination which purports to sort out the intellectual sheep from the gormless goats should be subject to scrutiny. It may be that this system artificially restricts the reservoir of the available national brainpower to a mere 20%.

The contribution of the female half of the population to the solution of the problem is as yet very small, particularly in engineering. The mere suggestion of help from this quarter quickly evokes the resistance of many men. All sorts of difficulties are cited to discount the idea. However, the pressure of the national crisis and our considerable experience of the useful contribution of women in industry during the last war was surely the answer to the objections of the traditionalists. If it was possible for women to run a foundry during the war, there are not many departments in engineering which can be considered inappropriate for their talents. The real problem in this connection is one of administration. Sir Harold thought that the impact of national service on the training of future technologists is a very serious one. The loss of two years and the interruption of professional training has had a most unfortunate effect on the development of our scientific and technological manpower, which deferment has not mitigated. As things stand now, the government might be well advised to spare greater attention to guiding youth rather than to guided missiles.

Yet with all its intense preoccupation with the need for more and more technologists, the Committee for Technological Awards is conscious of the dangers of producing a group of uncultured specialists. The pressure in this direction is very great but Roxbee Cox dwelt at some length on the need for a liberalization of studies so that future scientists would not emerge as ignorant of our cultural treasures as are some of our present administrators of science and its works. The Council is therefore insisting that colleges applying for recognition must show that they can provide adequate libraries, suitable social and cultural amenities, as well as the necessary laboratory and plant facilities for a technological course of the highest order. This last point is equally stressed. The Council has set its sights high. The "Dip. Tech." to be awarded under its aegis is to be comparable with a University Honours Degree and it is anticipated that most of the people taking the course will emerge with a Second Class Honours award. In this way such qualified people will enjoy parity of esteem with men and women possessing a University Degree and technology will come to be recognized nationally as of the first importance.

Having listened to Sir Harold we have no doubt that if the government is not acting as vigorously as it might to deal with our present technological manpower shortage this is not due to lack of good advice.

Polyester Car in Production

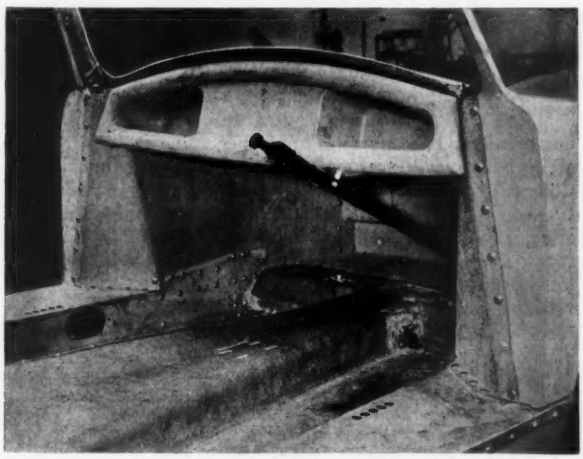
First details of the Opperman Unicar, made almost exclusively of plastics materials

ALTHOUGH various glass/polyester components have been used by the motor and commercial vehicle industry for some time, the concept of the all-plastics car body has, until recently, remained a designer's dream. We were therefore greatly interested at the news that S. E. Opperman, Ltd., the well-known engineering concern of Boreham Wood, Herts, has put into production, after three years experimental work, a car having a body entirely constructed of glass/polyester materials. After a close study of the production line at the factory, we have a number of interesting facts to report which, we feel, keynote a fundamental change in body construction.

The Opperman Unicar, it is important to stress, is being built down to a price (£399 10s.) which makes it extremely competitive with any other four-wheeled saloon car. Price has been largely instrumental in the selection of glass/reinforced plastics as the medium of construction, since at this stage of development pressed metal bodies would be impossible, and panel-beaten aluminium would, in terms of labour alone, be manifestly too expensive.

As might be expected, Opperman's have approached the problems from the standpoint of the engineer. Throughout the three-year experimental programme, they have studied contact-pressure moulding as a means of producing a precision component, and first in their minds has been the question of control over the process at all stages. To achieve this, their resources have been fully employed to tool and jig the production line in terms of metal, forcing the plastics components to meet exceptionally rigid tolerances. They have also established at the beginning of the production line, where the actual moulding is carried out, a series of works orders all designed to hold the chemical aspect of manufacture within controlled limits.

We commend especially the booth housing two chemical burettes, one containing the peroxide and the other the naphthenate, which the operatives have been trained to use, and which make possible *accurate* measurement, whether in small or large quantities. We commend also the standard of cleanliness in force, under which each brush is chemically cleaned after each operation, and whereby excellent washing facilities for the operatives, including air-dryers for the hands, are supplied. This reduces the risk of dermatitis and also helps to maintain a uniformly clean factory. We may say that this production line

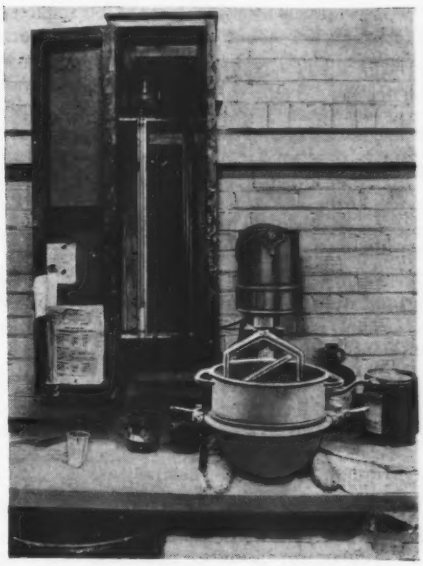


is the cleanest and most efficient we have yet seen, despite the sticky and dirt-promoting nature of the process.

Ten separate moulds are employed to make the following components: bonnet, boot, roof, chassis tray, engine cover, offside door and liner, nearside door and liner, offside and nearside wings, and dash panel. Aluminium is used for the moulds, and a large oven, maintained at 100° F. is employed to accelerate cure. Chopped strand mat only is used, and moulds are wax polished for release.

For the many re-entrant curves employed in the mouldings (several are split-tools) special wooden tools have been made to assist the operators; again the engineering influence at work. This has been extended to the assembly line where metal jigs are employed to bring the various mouldings together for bolting.

The photographs on this page will amplify the foregoing notes. In addition to the glass/polyester materials employed, p.v.c. extrusions are used for beading, p.v.c. for upholstery and floor coverings, and polyurethane squabs for the rear seats. The dry weight of the car is 6¼ cwt., the overall height 4 ft. 3 in., and the overall length 9 ft. 6 in. Production is being geared up to 50 a week, with an eventual target of 100 a week.



(Right) Weighing and mixing bench. Note burettes in booth and mechanical mixer.

(Left) Interior of car during assembly, showing method of bolting components together.

Plastics in Proportion

By P. A. DELAFIELD, M.A.(Cantab.)

The British Plastics Federation held a conference at Torquay in September. Four papers were read, all of which we hope to reprint in "Plastics." The first, which we publish here, offers a review of the plastics industry and considers possible future developments.

WE, who look to the Plastics Industry for our livelihood, our industrial fun and the satisfaction, at any rate, of part of our creative desires, are rightly and justly proud of the progress that we have made as an industry during the last 25 years.

I feel, however, that sometimes some of us, no doubt because we are so keen on the job, are inclined to forget the outside world of industry and tend to lose our sense of proportion.

As a beginning what I want to do to-day is to take you with me and look for a few minutes at this other industrial world, and compare it with Plastics. I say "compare" because I don't want to flood you with tonnage statistics and weight ratios and values—I just want to build up a simple growth comparison for your consideration.

In the first place, let us look at the U.K. output of plastics materials for 1955 as compared with the rest of the world. The U.K. produced about 350,000 tons, the U.S.A. 1·3 million tons

THE AUTHOR

Peter Delafield is a director of British Resin Products, Ltd., British Geon, Ltd., and Distrene, Ltd. Born in 1906, he was educated at University College School and Jesus College, Cambridge. Deputy Controller with Plastics Control in the Ministry of Supply during the war, he has also served as Chairman of the British Plastics Federation.

and the whole world, excluding Russia, I think we might therefore conservatively estimate at about 2·5 million tons. The U.K. thus accounts for about one-eighth of the world output, and that simple figure puts us in proportion to the rest of the world.

Going on to the next step, I suggest we look back over the last 25 years in our own country. To begin with, the population has risen from 46 millions in 1930 to about 51 millions in 1955, an increase of 11%. Plastics output has risen from, say 7,000 tons per annum, to 350,000 tons—a 50-fold increase. But the use in the U.K. of the basic materials of construction has also risen substantially, although not in anything like so handsome a fashion as plastics.

Let me just give you a few simple facts, and don't forget to think tonnage wise as well as percentage wise.

Rubber consumption has increased 4-times, and is running at about 300,000 tons.

Copper has gone up 3½-times, and is running at about 488,000 tons.

Steel has increased 2½-times and is now about 20 million tons.

Cement has increased 2½-times and is running at about 12 million tons.

Internal combustion engine fuel has increased about 3-times and is running at about 12 million tons.

Timber, on the other hand, certainly seems to have felt the impact of plastics, as well as other materials, as the consumption would appear to be about one-half in 1955 compared to what it was in 1930.

Now just a word about prices.

The prices of the older plastics materials, such as for example, phenolics and others based on coal tar distillation, have risen over the last 20 years. On the other hand, the newer thermoplastics, that is to say polystyrene, p.v.c., methylmethacrylate and polyethylene, have tended over the years to go down in price as production has increased substantially, and the basic materials from which they arose have become available in ever-larger quantities.

The wholesale prices, for example, of plastics materials, which were taken as 100 in 1950, rose to 127 in 1952, but came back to 117 in 1955. You must consider this information against the background of older materials such as rubber, tin, copper and steel, all of which are from three to eight times the pre-war price, and even cement is 2½-times the 1930 price figure.

So much therefore, for a general review of the position. Where do we go from here?

I believe that we, as an industry, are moving right out of industrial adolescence. If I am right, then the mistakes arising out of youthful enthusiasm should become less frequent and I might add also there is less excuse for them if they do arise. We have a formidable list of B.S.I. standards covering specifications and performance relating to materials and manufactured goods. These are constantly being added to by the joint efforts of companies in the industry, by our Federation and by the British Standards Institution.

But, if our industry is to reach full adult status, there is still much to be done and it is as well if we constantly remind ourselves of this plain fact.

Not only must the buying public be educated in the use—the correct use—of plastics, but skilful publicity must tell the public of the real worth of the new materials. Although plastics are part of our everyday life, their usage still points to the adage that a little knowledge is sometimes a dangerous thing. If I may be slightly frivolous for a moment this point can be illustrated not by the housewife who put a polyethylene washing-up bowl under the wheel of a 10-ton lorry, but rather by the housewife who put it on a flaming gas stove.

Much has yet to be done by plastics manufacturers whether they make raw materials, sheet, rod, tube, mouldings or other forms of assembly, to make doubly certain that the right material and the right fabrication techniques are used.

Now I think it is safe to say that our industry has attracted intelligent and hard-working young men and women with plenty of technical skill, administrative ability and imagination. Competition for high quality brains and skill is as great as it ever was and it is up to this industry to make sure that the tempo and quality of progress is maintained so that these young people should grow up happily with our industry and not fall too much for the attractions of other industries.

You may wonder what I am getting at. Well, it is just this. Namely, that the figures I have quoted comparing the growth of plastics with that of traditional materials may give rise to an attitude of complacency. I would ask you to dwell on the thought that the use of these new materials and techniques has only just begun in this country and a more positive effort to show their worth in new applications is clearly called for.

Having said this I would, however, be the first to admit that the thinking, both research and engineering wise, has been fertile and the activities energetic and powerful and it would not be fair in saying what I have said so far, if I did not review a little further, and on broad lines, what has been happening and what I think may be happening in the years to come.

Within the last two years we have all become familiar with new polyethylene materials, new copolymers of p.v.c., new polystyrenes and a host of other new materials, all of which look as though they will contribute to the betterment of living.

Research on the reaction of nuclear energy on certain chemicals proceeds actively, and who knows when the phenomenon of polymerization as we understand it to-day may be entirely changed into cheaper and more efficient processes with quite startling results in the properties of the ensuing products?

So far, we have used organic plastics materials. The field of inorganics and plastics based thereon can well be fertile, and certainly must be well prepared too, if we are to meet the ever-increasing stresses and temperatures that modern industry and locomotion demand.

This is not the place for a scientific dissertation on this matter. Indeed I am far from fitted to speak on such matters. But I have referred to it because I believe it will not be long before something happens in these directions.

On the application side, I see over the next few years some of the newer plastics materials making substantial inroads into the glass container and pipe industries. Not necessarily because they are cheaper *per se*, but because in the ultimate end they will be more efficient and therefore more economic.

I have often said that if glass were invented to-day, its promoters would have a bad time trying to sell the idea of its use for quite a number of those applications for which it is used to-day—used only because until recently there was nothing else available. I might add as a rider that I believe those responsible are also going to have a problem to keep glass and other conventional container materials going for quite a number of uses as we now have sterilizable thermoplastic materials for use on the established techniques of moulding and blowing.

I have just referred to pipes. As often happens when our friends, the non-technical journalists get hold of an idea, a certain amount of misrepresentation occurs. But for certain applications, as all you experts know, a lot of piping made from plastics has been produced and is giving extremely satisfactory service. I believe its use will expand enormously not only in this country but all over the world, *but not* until the techniques of application have been worked out and the pipe fitters and plumbers of this world, and also the builders and architects and authorities concerned have also been educated and convinced.

I stressed earlier the importance of this particular point of education and skilful publicity. You know, gentlemen, it is not good enough to be ahead of your time and to have bright ideas and new materials up your sleeve or lying out on the laboratory bench. You must have, I suggest, first the technical facts, second the belief in the project, third the patience, fourth the ability to educate the operators and your public the consumers, and fifth the capital. I wouldn't like to put these five points in order of precedence—I'd prefer to bracket them together.

This industry is highly geared capital-wise, and is likely to remain so. As is the case with other major industries, obsolete plant and techniques have no place in our modern world, and on top of this the advent of new materials and techniques calls all the time for a steady rich stream of money. This is only justified if production increases and the return on the capital invested is economically sound. So where do we go from here—because this is perhaps really where I came in.

Excluding the U.S.S.R., the world production of plastics, now 2½ million tons per annum, can be getting on for 4 million tons in five years time. The optimistic plastics happy boys in the U.S. are talking of production in that country up to 2·7 million tons in 1960–61, in other words double the present U.S. output. My own feeling is that this is on the high side. But I don't think it unreasonable to assume that the U.K. production in five years' time will be up to 500,000 tons a year. We in this industry are working with that target before us. It is our livelihood and our interest and a very fascinating one too, as I know you will all agree.

Therefore, as we gaze hopefully into that crystal ball no longer made of glass, let us be sure of ourselves without being conceited, and let us always be mindful of other materials, their qualities and the economics of their use.

PLASTICS EDUCATION

CITY AND GUILDS RESULTS
FINAL EXAMINATION

Borough Polytechnic.—Roy Baxter (1st), Michael Cox (2nd), John Millard (1st), Michel Rozenblat (2nd), William Whiting (2nd), Anthony Brown (1st), David Dempsey (2nd), Peter Freeman (2nd), John Molyneux (1st), Brian Palmer (2nd), Michael Phillips (2nd).

Birmingham College of Technology.—John Atkins (2nd), John Brierley (2nd), Robert Burke (2nd), Kenneth Carter (2nd), John Grice (2nd), David Heathcock (2nd), John Holland (2nd), Anthony Holliwell (2nd), Brian Poole (2nd), Mervyn Richardson (1st), Michael Roll (1st), Brian Tildesley (1st), Geoffrey Wall (2nd).

Stroud & District T.C.—Peter Caldwell (1st), Geoffrey Brian (2nd), Allan Worth (2nd), Derek Smith (2nd), Kenneth Jones (2nd).

Newton Heath T.C., Manchester.—Alan Ashworth (passed 1st paper), Clifford Greenhalgh (passed 1st paper), Bernard Main (passed 1st paper), Eric Daniels (2nd), Alwyn Smith (2nd), Howard Clarke (passed 1st paper), John Donnelly (passed 1st paper), Peter Frankland (passed 1st paper), Erich Gutwillig (passed 1st paper), Keith Lindley (passed 1st paper), Keith Martin (passed 1st paper), Leslie Walker (passed 1st paper).

National College.—James Barker (passed 1st paper), Alan Schaffer (passed 1st paper), Ian Hayward (1st), Arnold Ross (2nd), Derek Williams (passed 1st paper), John Shawley (passed 1st paper), John Wright (passed 1st paper).

Birmingham College of Technology.—John Buckingham (passed 2nd paper), David Worth (passed 2nd paper).

EXAMINATION PAPERS

In recent issues of *Plastics* we have published some of the questions set in the recent examinations of the City and Guilds of London Institute and the Plastics Institute. The following questions are taken from its final C & G papers on Materials and Processes. Three hours were given to answer six questions out of a total of nine.

1. Write an essay on silicones.
2. Compare the physical properties of glass-fibre reinforced laminates bonded with phenolic, melamine formaldehyde and silicone resins respectively.
3. Describe three tests to distinguish between films made from cellulose nitrate, cellulose acetate, and polyethylene respectively.
4. Write brief notes on how the following raw materials are used in the commercial production of plastics:—
   (*a*) phenol,
   (*b*) ethyl alcohol,
   (*c*) di-octyl phthalate, and
   (*d*) acetic acid.
5. Define addition and condensation polymerisation. Give three examples of each type.
6. Indicate briefly the scope of B.S.1137 (Synthetic resin-bonded paper sheet for use at power frequencies). Describe the method used for the determination of tensile strength.
7. Give the structure, and compare the chemical and physical properties of three members of the ethenoid group of plastics.
8. Discuss the uses and importances of plastics in packaging.
9. Describe the preparation of moulds suitable for the production of large contact (low pressure) laminated mouldings.

Hinges for Plastics Containers

By W. BRUCE BROWN, M.S.I.A., F.R.S.A.

An illustrated review of the methods of hinging commonly employed

THE hinges used on plastic boxes may be classified into three categories: (*a*) those completely integrated in the mouldings, so that no other pins or screws are required, (*b*) those which utilize a hinge pin threaded through moulded knuckles, and (*c*) metal hinges applied by an assembly operation.

Integral Hinges

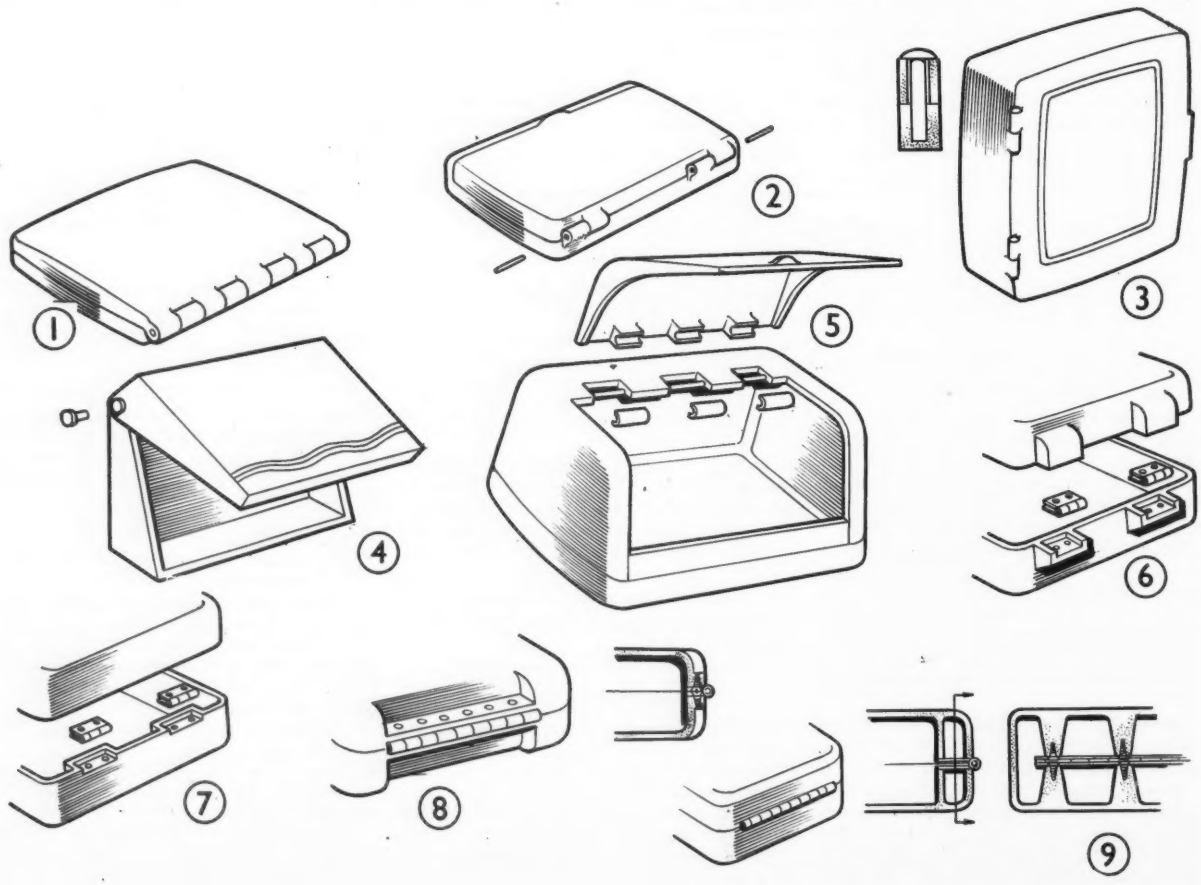
These usually rely upon the inherent spring or flexibility of the material, and are therefore normally confined to thermoplastic materials. By flexing some part of the box or lid, the two parts are sprung together. This operation should be carried out as soon as possible after moulding, before the material has stiffened up. Fig. 1 shows a simple snap-on type of hinge in common use for small injection-moulded boxes with light contents, such as sewing sets, razor boxes, and ring containers. The lugs on the lid are flexed apart and snapped over the moulded spigots on the box. In Fig. 2 the sides of the box are recessed at the hinge so that the sides of the assembled box will be flush.

Fig. 3 illustrates an integrally-moulded hinge suitable for flexible polythene containers, with either a polythene or rigid plastic lid. This type has been used on waste bins, lunch boxes, bread boxes, and so on. The lid shape is straight-forward for moulding. The sockets on the body are slightly undercut, but in polythene the mouldings may be simply sprung out of the tool.

In figs. 4 and 5, flexible polythene bodies and lids are moulded in one shot, connected by a strap which allows the lids to be bent round to meet the bodies. The position and radius of bend of the straps are important; if they are bent too acutely the material becomes fatigued and is likely to crack and break. Fig. 4 would be suitable for tubes for tablets, and Fig. 5 for binocular cases.

Fig. 6 shows a hinge suitable for boxes of 6 in. and upwards in length. The length is necessary to allow sufficient flexing of the back wall of the box to permit assembly. As the undercut holes in the lid knuckles both face in the same direction, the mouldings may be removed from the tool by sliding them off sideways. To retain the lids on the boxes, interfering projections are moulded near the centre of the back walls of box and lid. By pressing on the centre of the back wall while assembling, the projections may be forced past each other, after which they spring back and prevent the lid from being pushed off again.

An American type of hinge for small thermoplastic boxes is depicted in Fig. 7. Very small undercut dimples are moulded in the sides of the cut-outs of the box, which engage with pimples on the lid projections. These undercuts are small enough for the mouldings to be forced out of the tool, but the



extra thickness at the hinging bosses gives a rigidity in polystyrene such that considerable force is required to separate box and lid after they have been snapped together.

Hinges with Metal Pin or Moulded Spigot

Mating knuckles of the hinge may be moulded on box and lid, the holes being either moulded or drilled. In assembling the parts, the hinge pin may consist of a piece of wire on very small boxes, or a self-tapping screw, tubular rivet, eyelet, bifurcated rivet, or a moulded spigot cemented in. All but the last would be suitable for thermo-setting materials. Figs. 8 to 12 show examples of these methods.

Fig. 8 shows a cigarette case with fine holes through hinge knuckles moulded by a withdrawing piano wire in the tool.

A small snuff box in urea is shown in Fig. 9. Mating moulded knuckles on lid and box pinned with lengths of brass wire, passing through clearance holes in first knuckle and driven into slightly undersized holes in second knuckle.

Fig. 10 shows a bathroom cabinet. Moulded knuckles are pivoted on a moulded spigot passing through a clearance hole in upper knuckle and cemented into the lower knuckle.

Fig. 11 would be used for a razor box with moulded spigot in contrasting colour acting as hinge pin, assembled as in Fig. 10.

Fig. 12 shows a bread bin in polystyrene with hinged lid. The small pieces are cemented to clamp the lid to the moulded rods on the body. The bottom of the bin is a separate moulding cemented after assembling the lid.

Metal Hinges

When the box is large, or its contents heavy, it may be advisable to use a metal hinge of some kind, to be applied to the box after moulding. A pair of small cabinet hinges may be used, moulded locations being provided, and attached with self-tapping screws driven into moulded holes. The hinge bosses may project externally as in Fig. 13 or internally as Fig. 14, according to the shape of the contents of the box.

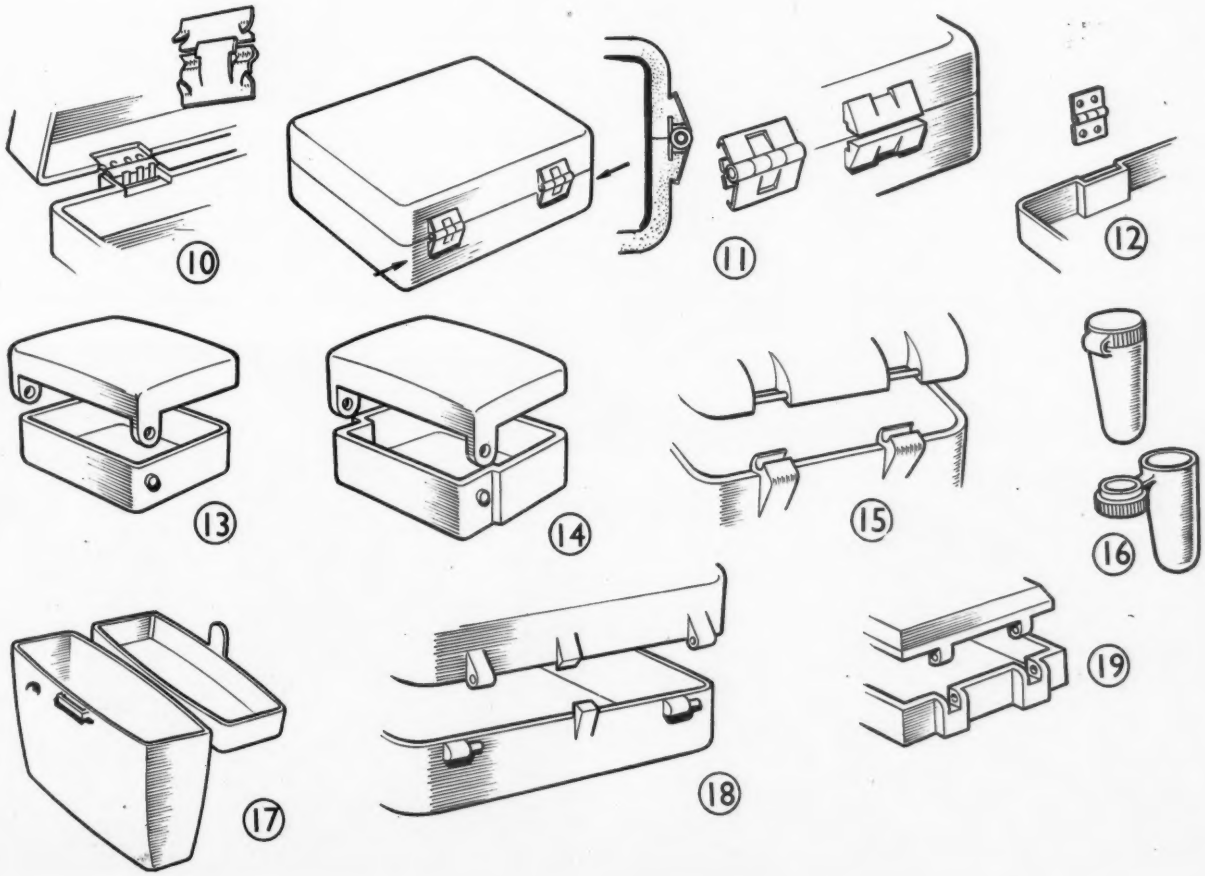
When two hinges are used, they must be accurately aligned. The assembly of a single length of continuous-extruded piano-type hinge is less critical and allows for more fixing points. Continuous hinge may again project from the box, or be concealed, as illustrated in Figs. 15 and 16. In Fig. 15, the piano-type extruded hinge is used externally, and in Fig. 16, internally.

There are also several types of patent hinge specially designed for attachment to mouldings without the use of screws.

Illingworths (Plastics), Ltd., of Sutton-in-Ashfield, Notts., manufacture several patterns of hinges which are simply pressed home into specially-shaped recesses in the mouldings. They have a snap-open, snap-shut action through 90°, and are retained in their slots by punched-out barbs in the metal. An example is shown in Fig. 17.

The writer devized the hinge pictured in Fig. 18, which is slid on to projections on box and lid. A punched-out tongue on the hinge springs into a groove in the moulding when the hinge is being attached, to prevent the hinge from being removed. This patented hinge requires no screw fixings and is easily attached. Lid and box cannot be pulled apart manually, as with hinges which are retained by friction fit.

Williams & Gray, of 75 Villa Street, Birmingham, 19, manufacture a useful and inexpensive small hinge which may be pressed into simple moulded slots in box and lid. Being of the ordinary pin type, it will open the lid to 180°, and is $\frac{1}{2}$ in. wide. A sketch is given in Fig. 19.



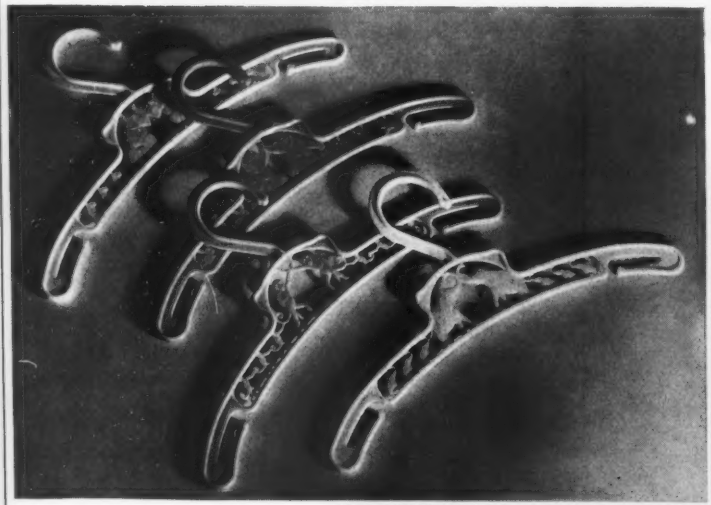
PLASTICS
IN THE SERVICE OF MAN

A pictorial review of high-quality units moulded or otherwise fabricated in Great Britain . . .

69. Plastics in the Nursery-II

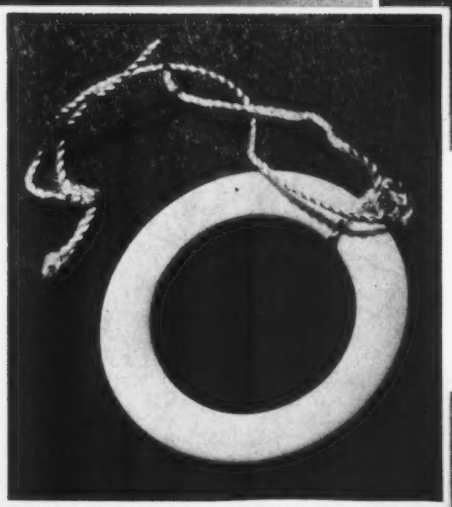
A list of trade-marks and companies mentioned in this review, with full names and addresses, appears on page 317

(Above) Rayon baby pants lined with p.v.c. manufactured by Raywarp Textiles Ltd.



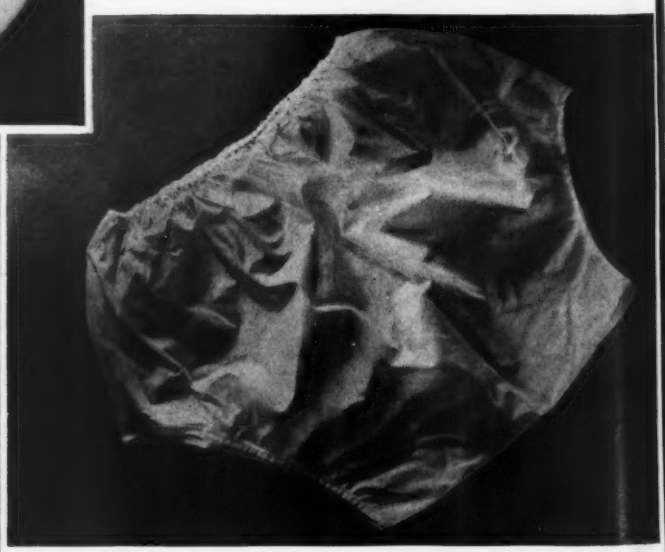
(Above) Baby coat hangers moulded in polystyrene by O. & M. Kleemann Ltd.

(Above) Baby pants manufactured in p.v.c. by P. B. Cow and Co., Ltd.

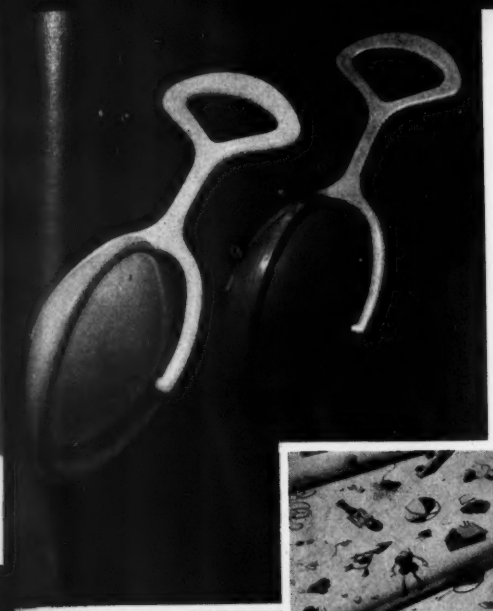


(Right) Teething ring moulded by Airfix Products Ltd.

(Below) Baby pants made from Velbex p.v.c. by Bejoss Ltd.

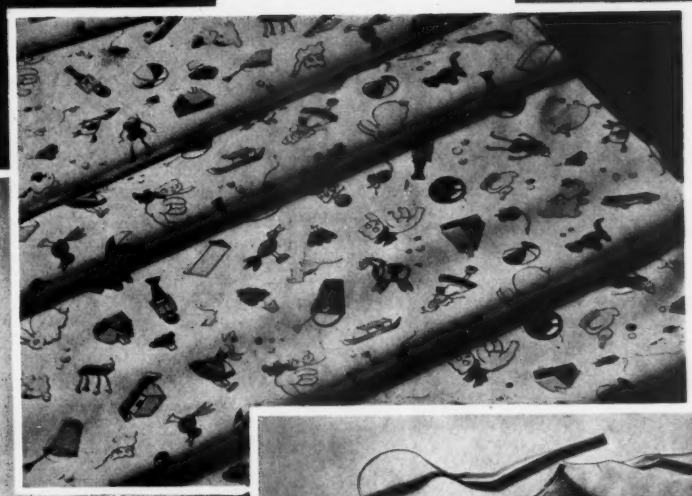


(Left) A selection of Rattles moulded in polystyrene and acetate by Combex Ltd.



(Left) Injection moulded rattles produced by Injection Moulders Ltd.

(Right) Polythene pots moulded by Cumbrian Mouldings Ltd. for Projects (Coventry) Ltd.

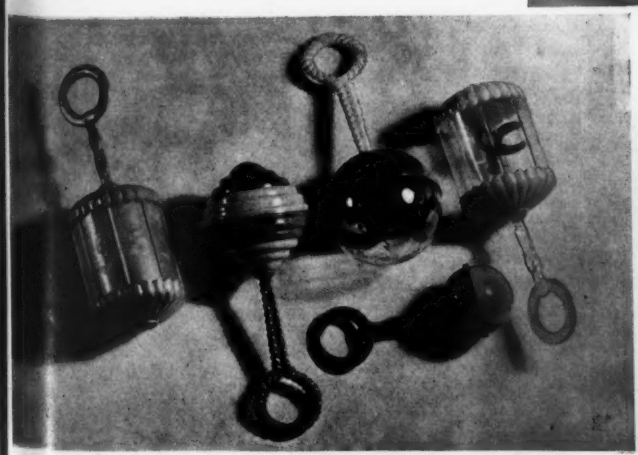


(Left) Nursery design Velbex p.v.c. sheet manufactured by B.X. Plastics Ltd.

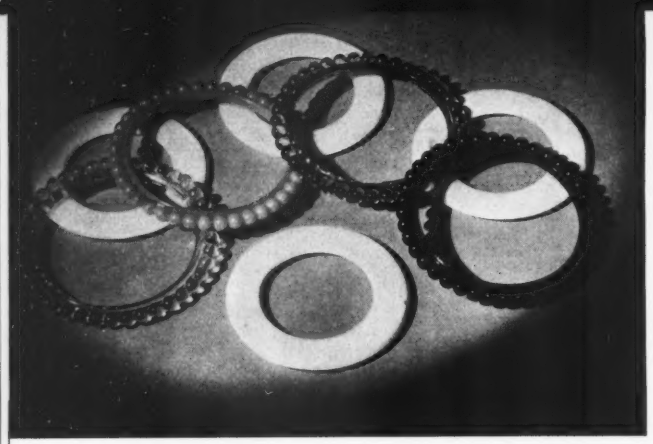
(Below) Feeder manufactured from p.v.c. with a towelling "dribble catcher" and a p.v.c. lined bib with a squeaker fitted. Both are manufactured by Kleinert Rubber Co., Ltd.

(Above) Building beakers moulded in polythene by J. & L. Randall Ltd.

(Below) Printed p.v.c. tablecloth and p.v.c. lined baby pants with frills and covering in nylon material manufactured by Kleinert Rubber Co., Ltd.

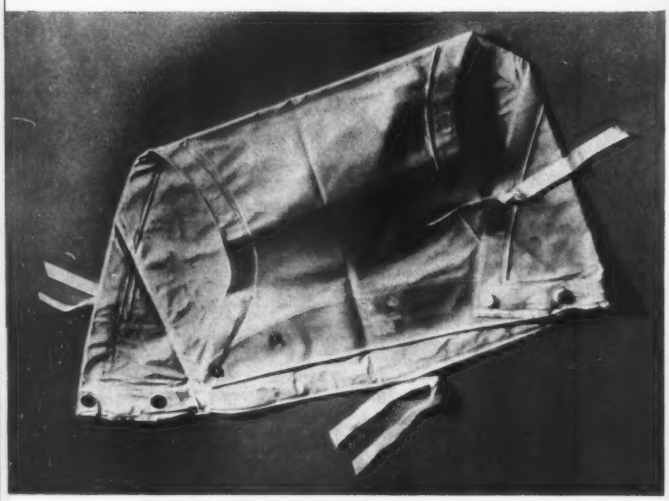


(Above) Novel rattles moulded in polystyrene by Vogue Playthings Ltd.



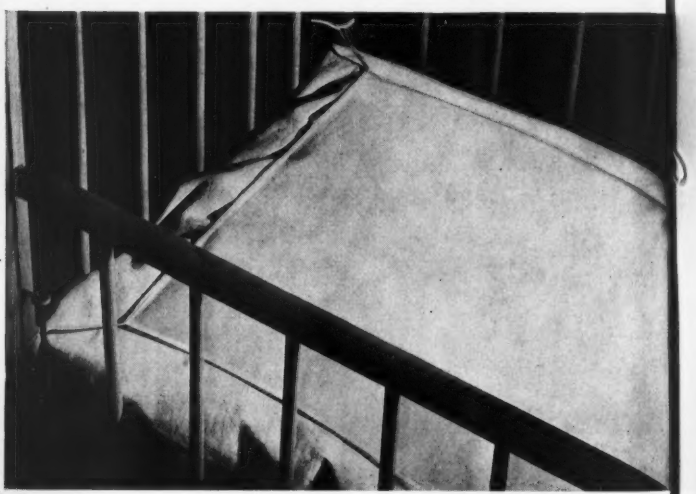
(Above) Teething rings and jingle bangles moulded by Injection Moulders Ltd.

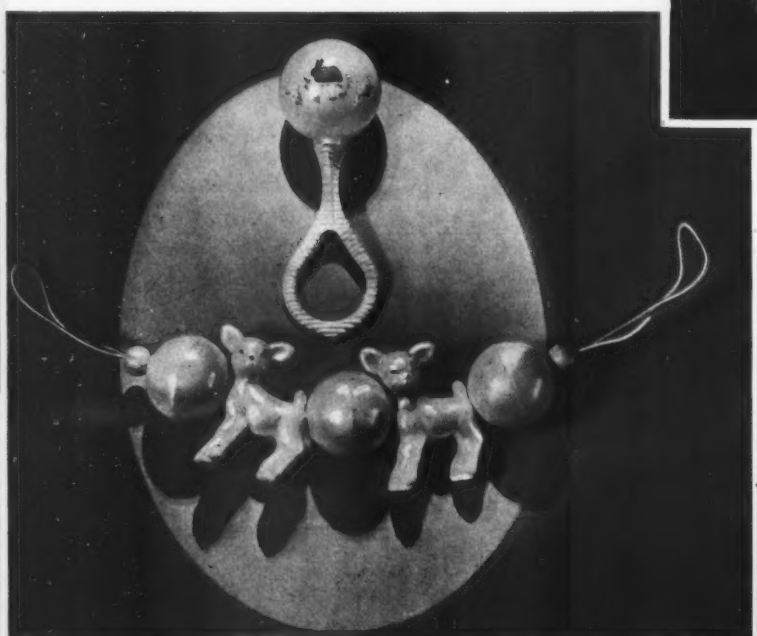
(Above) Nursing Apron of Terry towelling with a detachable p.v.c. lining manufactured by Kleinert Rubber Co., Ltd.



(Above) Paddi p.v.c. baby pants with adjustable leg and waist nylon ribbons for use with the disposable Paddi pads. The pants and pads are manufactured by Robinson & Sons, Ltd.

(Below) Velbex p.v.c. cot sheet.



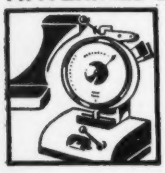


(Above) Polystyrene rattles moulded by Cumbrian Mouldings Ltd. for Dean's Rag Book Co., Ltd. and Projects (Coventry) Ltd.

(Below) A printed p.v.c. feeder with crumb-catcher made by Raywarp Textiles Ltd.

World's Industry Employs Plastics

MATERIALS and TESTING



Moisture absorption of thermoplastics can affect the dimensions of mouldings to such a degree that their technical use is impaired. The swelling process has been investigated by W. Eulitz mathematically and a simple formula developed. The moisture sensitivity of each type of thermoplastic can be expressed by a specific constant useful for design purposes.
(*Kunststoffe*, 1956/Sept./403.)

Energy absorption of thermoplastic films.—Accurate information of energy absorption and emission of plastic films irradiated by light and heat would facilitate prediction of the behaviour of materials under the various conditions of manufacture and use. Examples are: heating with infra-red radiation, temperature measurement with radiation pyrometers without surface contact, manufacture of military camouflage fabric, prediction of maximum temperatures in the material under various kinds of irradiation, for predicting the behaviour under light and heat radiation through atomic bomb explosions.
(*Kunststoffe*, 1956/Sept./407.)

Lubricators of plastics.—Recently lubricators have been developed replacing the hitherto used metallic lubricators (Staufferbuechsen). The main advantages seem to be lightness and resistance against damage owing to the flexibility of the used plastic.
(*Technica* (*Basle*) 1956/Aug. 31/930.)

Ethoxylen-cast resins.—A survey is given of the development, properties and engineering applications of modern ethoxylen resins.
(*Technica* (*Basle*) 1956/Aug. 31/943.)

Identifying plastics by infra-red spectroscopy.—D. Hummel discusses the theoretic and practical limitations of infra-red analysis. He suggests a systematic plan for the infra-red analysis of plastics and lacquers.
(*Kunststoffe*, 1956/Oct./442.)

Osmotic measurements of macromolecular substances.—H. Hellfritz and H. Kraemer discuss factors which must be considered in osmotic measurements. On the technical side there are construction handling and care of the osmometer and, with regard to the membranes, there are the choice of the material treatment and testing by control substances.
(*Kunststoffe*, 1956/Oct./450.)

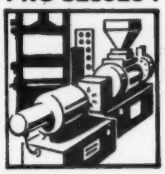
Combustability and inflammability of plastic foils.—H. Mendrzyk has developed a new instrument after that of Willbourn which can be easily assembled and cleaned. It seems to be suitable for the evaluation of inflammability of plastic foils which are freely suspended and exposed to a flame of medium intensity. Average variation could be reduced from 11 to 5%. The method initiates the behaviour of foils set alight by a small source of fire, such as a thrown-away match.
(*Kunststoffe*, 1956/Oct./489.)

New plastic tooling material.—According to J. Ross, Versamid, a polyamide resin has shown many desirable properties of interest for plastic tooling. It shrinks little on casting, has great strength and impact resistance, is not porous and has a high degree of adhesion. There is no evidence of toxicity. The material can be used on large castings since relatively little heat is given off when epoxy is mixed with the polyamide resin.
(*Tool Engineer*, 1956/Aug./195.)

Chemistry of glass-fibre plastics.—J. Kuchenbuch gives a detailed survey of the chemistry of unsaturated polyester resins used in the production of glass-fibre plastics.
(*VDI-Zeits*, 1956/May 21/829.)

Properties of low pressure polyethylene.—G. Wick and H. Koenig of Chemische Werke Huels deal with the general physical properties of a new polyethylene material of high molecular weight and the methods for processing this material. The ageing characteristics and stress cracking are dealt with. Detailed information on manufacture of pipes and of socket joints is given.
(*Kunststoffe*, 1956/Oct./460.)

PROCESSES : MACHINERY



Experience with twin-screw extruders.—K. Tanner made a detailed study of the operating conditions of twin-screw extruders and suggests certain improvements in the design of these machines. The adjustment of viscosity through temperature reduction in the melting zone permits complete dispersion of grains, which would be troublesome in the end product. In this way the working range of the machine can be considerably enlarged.
(*Kunststoffe*, 1956/Sept./429.)

How to choose plastic dies?—W. J. Esdale compares good and bad experiences with plastic dies. The following question should be considered: (a) how many pieces are to be formed, (b) how much work-change should be accomplished? what are the tolerances, (c) what is the end product (good appearance), (d) does the design of the stamping readily lend itself to the use of plastic, (e) are multiple metal inserts required by severity of operation, (f) how soon is the first piece needed, (g) is enough machining capacity available for fitting, (h) how much capital is available for die construction?
(*Automotive Industries*, 1956/Aug. 15/56.)

Tapping screws for plastics.—W. Yerger and S. Begg give a detailed design guide to the selecting of tapping screws for plastics. They distinguish three types of thread forming (self-tapping screws), five types of thread cutting and one type of metal driving screws. They then present a list of plastics and their main properties and indicate the type of tapping screw in order of preference.
(*Machine Design*, 1956/June 28/97.)

Injection moulding of cast resins.—E. Deux gives a survey of both casting as well as injection moulding methods and compressed air vacuum injection methods developed for Araldite cast resins.
(*Technica* (*Basle*) 1956/Aug. 31/927.)

INDUSTRIAL APPLICATIONS

Epoxy insulation in tape form.—One electrical tape is made of a glass cloth, another of non-woven polyester mat. Both are impregnated with uncured thermosetting epoxy resin. After oven curing the resin sets into a hard, homogeneous mass around the protected piece. Uses include insulating of coils or conductors, insulating field windings by curing in their slots, wrapping toroidal windings, etc.
(*Machine Design*, 1956/June 28/5.)

Application of epoxy resins for glueing.—W. Schaefer and H. Jahn describe joints for pure shear stresses and methods for the testing of glued joints. Recommendations for the correct design are given.
(*Fertigungstechnik*, 1956/July/304.)

Mylar-A high strength film.—D. D. Lanning deals with physical chemical and electrical properties of a polyester film useful over a wide temperature range. He gives also fabrication methods and typical applications such as for electrical insulation, magnetic recording, pressure sensitive tapes, metallized film, etc.
(*Product Engineering*, 1956/July/187.)

Production of nylon gears.—Detailed instruction how to machine gears of Zytel 101 are given. First step is to moisture condition blank by placing it in boiling water for a predetermined period, then allowing it to dry at room temperature for two weeks. Fairly high surface speeds with light feeds produce good results in machining.
(*American Machinist*, 1956/Sept. 10/160.)

An industrial tray moulded of glass fibre and polyester resin is stated to be a new application of reinforced plastic for industry. The pans weighing 7 lb. have a good strength to-weight ratio and flexibility. Rounded ends permit them to travel easily on conveyor lines.
(*Automotive Industries*, 1956/Sept. 1/59.)

MISCELLANEOUS USES

New bonding material.—Fluorethene sheets are treated on one or both sides and can be cemented to steel aluminium, wood, plastics, cardboard or rubber. Califilm (fluorothene Kel-F) available in thicknesses from 0.005 to 0.015 in. can protect surfaces from wear and corrosion. Kelon-F(Kel-F) sheets are available in thicknesses from 0.015 to 0.250 in. Applied to metals, plastics or woods these sheets give low friction, high corrosion and wear resistance.
(*Tool Engineer*, 1956/Aug./143.)

Some New Aspects of Polymer-to-Metal Bonding

By NORMAN STUART, Ph.D., B.Sc., D.I.C.*

The study of bonding films by interference microscopy. A report on some of the work at present in progress in this field

Introduction

A PREVIOUS article in *Plastics* (September, 1955, page 317) included three photographs illustrating part of the ancillary micro-photographic equipment, and a brief description of a specially designed Perspex cell for studying and recording on cine-colour film, the appearance as well as the kinetics of growth, of thin sulphide tarnish films forming on the surface of certain single-phase brass alloys. Of particular interest are those brasses in the alpha region of composition around 70% copper and 30% zinc, which have for many years, been commercially produced and well known in the form of the thin yellowish coloured electro-deposited films necessary to obtain successful rubber bonding. In *Plastics* for September, 1954, page 295, there also appeared an illustrated description of the author's design of a laboratory-scale experimental brass plating tank. In the present article it is accordingly proposed to describe some of the surface phenomena and to comment briefly on their significance in connection with bond formation and adhesion. All the "still" micro-photographs reproduced here were taken with a Leica III camera by the author, on 35 mm. Kodachrome Type A Film, with a "Pointolite" illuminant used in conjunction with the previously illustrated Beck metallurgical microscope and Vertiphase illuminator, as well as with an optical bench adjusted to provide "critical illumination" and permitting of the use of polarizing filters in the light source and occulars. The effective magnification of the micrographs on the opposite page is now 118 times the original.

A full account of related researches undertaken (of which this study forms only one part), will be given elsewhere in a forthcoming publication.

Certain fundamentally significant features which it is hoped will become apparent in the course of this article, can, however, only be properly interpreted with the aid of such coloured reproductions as are illustrated here. For those who are sufficiently interested to pursue this subject in further detail, a reference should be made to the paper by A. J. P. Tucker and T. P. Hoar on the " Growth of Sulphide Films on Copper " (*J. Inst. of Metals* **81**, p. 665, 1953). The author has been collaborating from time to time, with Dr. Hoar in Cambridge, on this subject, and therefore welcomes this opportunity of expressing his warmest thanks for the many stimulating discussions and, in particular, for the invaluable help given by Mr. C. Stockbridge who is now working with him, in taking and interpreting some electron diffraction photographs of certain sulphide films adhering to rubber surfaces.

Techniques and Results

In the discussion section of Tucker and Hoar's paper a reference is made to the fact that a cine-colour study is being undertaken on copper, and an explanation offered for some of the reasons why this technique is applicable to brass. A glance at Figs. 9 and 12 in that paper, will illustrate the very similar appearances (albeit in black and white) of those sulphide films formed on electrolytically polished and annealed copper and brass surfaces tarnished by a brief immersion in an alkaline polysulphide solution.

In the case of an annealed alpha-phase brass (consisting as it does of face-centred cubic crystals) the tarnishing behaviour is essentially similar to copper because in both cases, each individual metal crystal grain is then differently orientated from its neighbour, and on the surface of each one, a sulphide layer is formed at a different rate depending upon what particular crystallographic plane happens to be exposed to the tarnishing reagent. The resulting sulphide film, in fact increases in thickness, at a rate which under certain conditions is determined by the type of orientation of that crystal face being subjected to the reagent, rather than by the nature of the tarnishing reagent itself. It is presumably for this reason that we observe in both Figs. 1 and 2 a coloured " patchwork quilt " appearance which is characteristic of the effects first observed and illustrated by P. Jacquet (*Rev. Metallurgic* **42**, (1945) p. 133), for the action of an alkaline polysulphide solution on electro-polished copper. But this is only a superficial and obvious similarity.

The first two colour microphotographs reproduced opposite, show the differently coloured grains which were produced by a tarnishing reaction. This consisted of heating a rubber pad made from a conventional rubber mix containing carbon black 1.5% sulphur and accelerated by mercapto benzthiazole for one hour in a mould under slight pressure, in an electrically heated air-oven at 140° C. in contact with an annealed plate of electrolytically polished alpha brass containing copper 70.55% and having the dimensions 5 in. × 1¼ in. × .129 and a mean Vickers Hardness of 66.9. The interference colour of the sulphide film on any one single grain is strikingly uniform, and those readers with metallurgical experience, will at once recognise the characteristic appearance of several " twins " formed by annealing the previously cold rolled metal. Certain pairs of " twins," being as it were " mirror images " of the same crystal, and having the same surface orientation, appear to have tarnished to identically the same colour whilst the adjacent grains generally appear quite differently coloured. Strictly it should be noted here, as P. Lacombe and M. Mouflard have shown in their magnificently illustrated monograph on " The Application of Colour Microscopy to the study of Interference Tints formed by Thin Epitaxic Films " (Editions Metaux France, 1953) that an examination by polarized light using crossed nicols is necessary to characterize without ambiguity the absolute orientations in certain crystalline surface films such as relatively thick sulphide films on copper.

Nevertheless, with ordinary illumination, the general appearance is typical in every way of those conditions under which the growing sulphide film has thickened at a rate which has been controlled by the crystal grain orientation. This in fact means as C. Wagner has shown (*Trans. Farad. Soc.*, vol. 34, p. 851, 1938) that their thickness growth-rate is being controlled by the rate at which metal ions have been able to migrate through the already formed sulphide layer, away from the metal, towards the available sulphur which is being provided from the bulk of the rubber undergoing vulcanization. Presumably when vulcanization approaches completion, further thickening of the metal sulphide film comes to a standstill. This supposition is in any case capable of being experimentally verified, because the interference colour of a thin sulphide film is determined by its thickness, just as the " temper colours " on a piece of steel are an accurately known guide to the thickness of the air-formed oxide film produced by " tempering." The reaction rate can thus be estimated when once a set of calibrated reference standards has been prepared. It should now be stressed, however, that the specimens in Figs. 1 and 2 are *not* photographs of the brass itself, but of replicas of the sulphide films, viewed by reflection from the *rubber surfaces* which were vulcanized in contact with the brass, but did not bond to it.

In other words, the sulphide mosaic has first been formed on, but then become detached from, the brass substrate and has remained firmly adhering to the rubber surface. Furthermore, the brass surface itself finally appeared just as brilliantly polished as it had done originally. This simple observation suggests strongly that the rubber has failed to bond to the brass because such a type of sulphide film fails to adhere strongly to the metal. A trial was accordingly made to see whether one could at all easily detach another similar sulphide mosaic from the brass surface on to a strip of adhesive cellulose tape and subsequently removing it from the tape for examination by direct transmission with the electron microscope. Space does not allow of a further description of these experiments here, but it may be mentioned that on copper, it sometimes proved possible to detach the sulphide film but not always ! Evidence is accumulating to show that a sulphide film adheres morestron gly to certain crystal faces than to others, and further research at present is being directed towards this phenomenon, using the cut and electropolished faces of large, single crystals of alpha brass for the purpose. It is therefore with strong approval and support that the following statement is quoted from a lucid and

* Northern Polytechnic and National College of Rubber Technology.

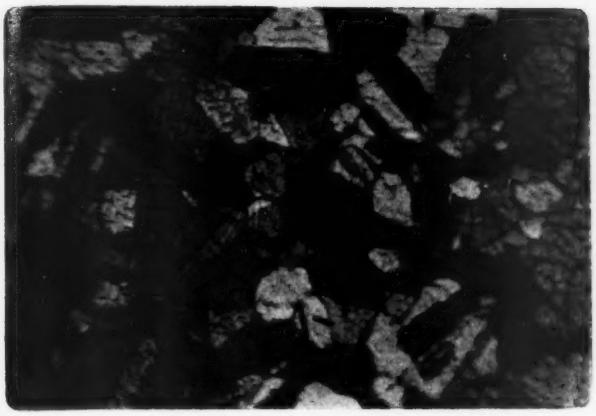


Fig. 1. Interference colours seen in a sulphide film " mosaic " adhering to a vulcanized rubber surface, and formed on it by curing in contact with an electrolytically polished surface of annealed alpha brass at 140° C. Micro-photos shown in Figs. 1 and 2 are taken from rubber surface in Fig. 6.

Fig. 2. Another part of the same specimen as in Fig. 1. In both photos, the " crazed " appearance within any one uniformly-coloured crystal grain is due to the cracking of the sulphide film when the rubber was flexed on removal from the brass.

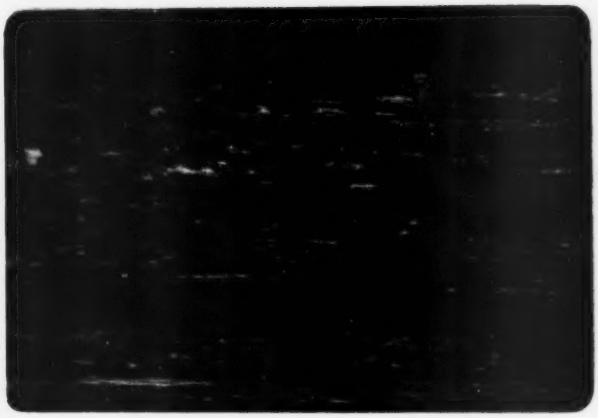


Fig. 3. Appearance, after removal of the partly-bonded rubber from the surface, of a poor-bonding alpha brass, electro-deposited on mild steel. Note the irregularly coloured tarnish patches on areas which have *not* bonded. The black lines are substrate scratches now clogged with bonded rubber.

Fig. 4. Appearance of a good bonding area on the surface of a suitably treated piece of annealed alpha brass. Even on the areas where no dark rubber is now adhering, the tarnish colours are notably more uniform.

Fig. 5. Typical appearance of two repeating " orders " of the interference colours which appear on the brass plate shown in Fig. 6 at the junction between the bonded rubber area (darker vertical rectangle on the right) and the brass area from which the bonding layer has been etched. The colours are analogous to " temper colours " on steel and are due to the uniformly graded thickness decrease in the bonding layer.

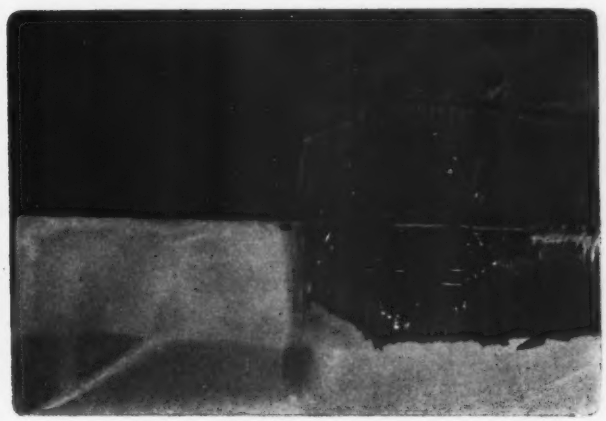


Fig. 6. A composite view (about natural size) of a portion of the originally annealed and electro-polished alpha brass strip, which was then given two further surface treatments, causing the rubber to bond to only one quarter of the brass surface. The piece of rubber which was vulcanized in contact with the whole of the brass surface, is shown " mirror-wise " beside it.

stimulating article by D. M. Alstadt appearing in the *Rubber World* for November, 1955, p. 221, on "Some Fundamental Aspects of Rubber-Metal Adhesion." In one paragraph headed "Structure and Nature of the Metal Surface," he writes: "Probably no topic in the entire adhesive field has received less attention than the effects of the structure of the metal surface on the adhesion produced between itself and the adhesive-polymer system. Failure of an adhesive bond is usually considered due to some inadequacy in the adhesive, and few attempts are usually made to modify the solid substrate to accommodate a given adhesive polymer." He then goes on to say, "It is ridiculous to omit consideration of the nature of the rigid surface to be bonded" and suggests certain variables which should always be considered whenever a polymer to metal surface is to be bonded. What follows in the remainder of this brief article, indeed directly goes to confirm Alstadt's claim, as well as providing an experimental proof of the main reason for the well-known and indeed notoriously unpredictable sensitivity of the present brass-plating method for bonding rubber to metal.

By contrast with the fairly uniform appearance of Fig. 4 it is apparent that Fig. 3 exhibits a more irregularly coloured surface tarnish film. This was observed after the rubber sample had been vulcanized in pressure contact with it in the usual way, on the surface of a poor-bonding electrodeposited alpha brass, plated on to an abraded and degreased mild steel strip. The horizontal black lines are deep scratches on the steel substrate that have become clogged-up with the vulcanized rubber which has bonded in these furrows and remained there. Elsewhere, the rubber has mostly failed to bond to the remaining areas, so these are exposed as an irregularly coloured greenish tarnish film, interspersed with spots of other bright colours due to some kind of lack of surface uniformity in the brass deposit.

It is proposed to elaborate this important topic at the conclusion of this article, but meanwhile Fig. 4 itself shows the typical appearance of a good bonding surface, although, of course, one cannot generally see the tarnish film on a well-bonded area unless either, the rubber happens to tear off the metal at the interface, carrying with it intact, a sample of the bonded sulphide layer, or else, to strip away altogether leaving this layer still adhering to the brass. Examples of both effects have been fortunately encountered, and when the latter occurs one gets a result of which Fig. 4 is typical; when the former occurs one gets a good opportunity of examining the type of sulphide film which has adhered strongly to the rubber. In every case so far investigated, the sulphide film has always appeared to be strikingly uniform in colour, and apparently structureless when viewed under a high-powered microscope objective, although proving capable of giving quite well defined diffraction patterns using a grazing-incidence reflection electron camera of the Finch type.

However, it is intended to perfect a technique for studying the progress of the actual bonding reaction by means of a cine-colour film record and a transparent rubber mix, which will be cured on the microscope stage, whilst the camera in contact with a suitable brass sample is in action. Meanwhile it can be claimed with some confidence, that the appearance of Fig. 4, is typical of what may later be seen in a film, except that there will no longer be any opaque bonded areas, and the colours will be changing with time. In Fig. 4 the dark-blue areas are due to some patches of rubber still adhering to the metal; the uniform light straw-coloured parts are the bare sulphide film itself. The actual specimen from which the photograph was taken, proved to be, on the whole, a well-bonded sample as exemplified by the fact that a "stripping-load" test on it, using the Model T.42 Dennison Stress-Strain Tester, gave a mean tear-off value of 78 lb. per in.

In the composite view of brass and rubber shown together in Fig. 6, the rubber had to be cut away with a knife from the quarter-bonded area seen in the two, right-centre panels, and it would normally have continued to bond along the left-hand central area of the brass if the metal had not been given a final treatment to etch away the bonding layer previously put on. The top left-hand corner of the piece of rubber is also shown cut off altogether.

Explanations, Implications and Applications

It is inconceivable, for one and the same piece of brass, cured uniformly in contact with one homogeneous sample of rubber as shown in Fig. 6 that there should be any significant chemical differences between different portions of the same sulphide film, whether adhering to the rubber or the brass. If, in fact, there are any crystallographic differences, then the electron diffraction and X-ray photographs should reveal them when comparisons are made between samples removed from different parts of the same specimen. Up to now, however, no such differences have been observed, so that whether adhesion occurs or not, must be primarily a function of the surface treatments and their effects on surface structure and orientation. Thus, the bonding on one quarter of the area, which is shown in Fig. 6, is an effect which is so easily reproduced, that it has been featured as a lecture demonstration experiment. The significant difference between the bonded quarter and its line of demarcation from the non-bonding area, lies largely in the cause of the effect reproduced in Fig. 5, and hardly if at all, upon such factors as stress or the degree of rolling or other kinds of cold-working, to which the metal as a whole may have been previously subjected, as has been claimed to be the case by several earlier workers (see, for example, S. Buchan's book "Rubber to Metal Bonding," p. 132 and p. 135). Precisely similar effects have been obtained on two identical samples, cut from the same brass sheet, when one was annealed and had a Vickers' Hardness of about 67, whilst the other was heavily cold-rolled to a mean Vickers' Hardness of 135 before electropolishing and surface-treating. On both these samples, it proved easily possible to put on, or remove at will, the necessary superficial bonding layer, although the softer of the two specimens proved to give slightly better adhesion as evaluated by a stripping-load test, thus contradicting the results of Hayford and Rogers just quoted. The effect shown in Fig. 5 was in fact photographed on an annealed brass surface, but it has been equally well observed on a cold-rolled brass after giving the surface its usual electropolishing and then a treatment to produce the bonding layer. It has also been seen (though in fainter colours) on the rubber surface adjacent to the spot where the rubber had bonded strongly, and the phenomenon is indicative of the presence on the metal surface, of an amorphous or supercooled and liquid-like layer of tapering thickness. Indeed, the tapering, or wedge-like character of this layer was intentionally imparted to it by the manner in which the etching agent was applied. When all of the layer is etched away, the progressive order of interference colours vanishes and so also does the ability to form a bond. Details of these experiments will be given in a later article, when the somewhat controversial nature of the properties of the famous "Beilby Layer" can be elaborated.

It may, however, assist the reader of this article to follow one most important point, if he is told that whereas the bonding layer on an annealed piece of alpha brass, may be etched off the surface and subsequently put back again as often as desired, this phenomenon cannot be repeated with an electrodeposited brass film of the same composition. If the electrodeposit is a good bonding sample, then an etching treatment will *not* remove or impair this property. To be able to grasp the significance of this experiment is also to understand the concept of "uniformity" correctly in this connection. This term has been used widely and ambiguously in the literature; it was also used earlier in this article with a warning. The concept to be conveyed is really a somewhat specialised, metallurgical one and must only be touched upon briefly now, because of its direct bearing on the problem of rubber bonding. Suffice it firstly to say that no mere homogeneity of chemical composition is envisaged; secondly, that although an electrodeposited alloy may be of chemically uniform composition throughout, yet it may still not be uniform. It may even consist of such a regular structure and grain size as to give clearly defined X-ray powder diffraction photographs and yet be non-uniform in respect of a large number of metal atoms which are disposed in a state which is far from the normal one of thermal equilibrium and occupying lattice-sites which effectively render them disarrayed or amorphous. They may also undergo what is known as an "order-disorder transformation." The problems of the structures of electrodeposited alloys, can thus be very intricate, since they are related amongst other factors, to the well-known property exhibited by many such alloys, of possessing an abnormally high hardness when they are deposited in a state of internal stress. This may cause a plating to curl-up, for example, when the substrate metal is dissolved away or becomes detached; it may also cause preferential corrosion under certain conditions. One of these conditions is in fact, the tarnishing reaction, which is, of course, a particular type of corrosion, and it is precisely this type of non-uniform tarnishing which was being illustrated in connection with Fig. 3. Space does not allow of a further discussion on this point since, in this article, it has been the author's intention only to describe actual practical results and not to speculate about their causes.

There are, of course, many still inexplicable observations, such, for example, as the apparent impossibility of being able as yet, to bond to a pure beta brass, using the techniques worked out for the alpha alloy. There is also the problem of the rate of cure of the rubber mix and its correlation with the optimum rate of tarnishing to give a strong bond. The

(*Continued on page 313*)

New Productions

Polythene baby bath.

Baby's Bath

A new, extra large, baby's plastic bath—the Ekco Superbath—complete with dual-purpose stand has been introduced by E. K. Cole Ltd., Southend-on-Sea, Essex. Injection moulded in polythene, the Superbath has extra depth which prevents water splashing over the sides, and a wide soap and sponge tray. A unique feature is the captive self-locking drain plug enabling the bath to be emptied without lifting it out of its stand.

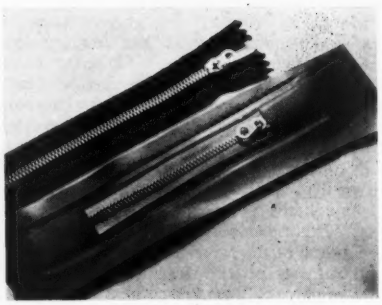
The dual-purpose folding stand is in polished beech wood and can also be used for holding a carry-cot. The bath measures 28½ in. long × 18 in. wide (at top) by 8 in. high.

Dairy Float

Built for United Dairies by Mickleover Transport Ltd., Whitby Avenue, London, N.W.10, this prototype dairy float which is now in service has a body constructed of glass fibre reinforced polyester resin. Primarily designed so that maintenance and repair costs should be reduced to a minimum an additional advantage is that a saving of some 80 lb. in weight has been possible which has enabled the battery range to be extended. The body is constructed in several pieces secured by bolts, for ease of maintenance and is supported on the chassis by light alloy cross-bearers. The load floor has already undergone stringent testing and reports indicate that it withstood the rough treatment of moving crates better than a wooden floor fitted with metal runners.

Zip Fastener for Plastics

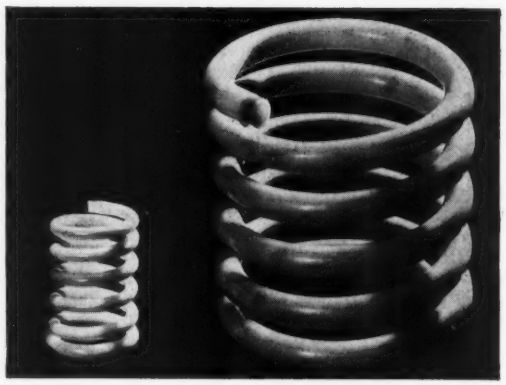
A zip fastener for use with plastics materials has been developed by Flex Fasteners Ltd., 5 Great Chapel Street, London, W.1, known as the Adhezip the fastener has a plastic yarn woven into the side tapes and can therefore be welded successfully on to the sheet material. The weld and consequent adhesion is very strong and should prove to be superior to a stitched fitting.



Coated Springs

Crane Packing Limited of Slough, one of the first companies in the United Kingdom to process and fabricate the plastic polymer polytetrafluoroethylene, have now succeeded in developing a process whereby springs can be covered with p.t.f.e.

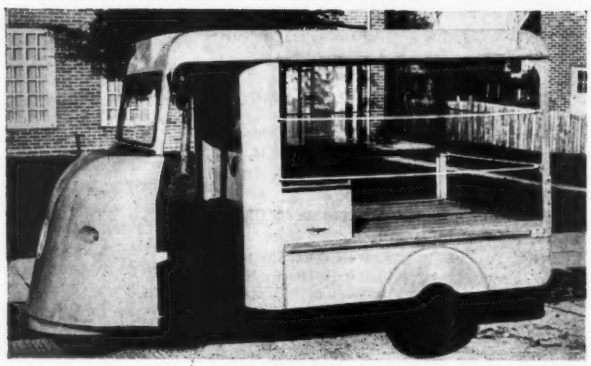
The coating renders a metal spring entirely impervious to attack by corrosive substances, with the sole exception of fluorine and the molten alkali metals. Springs so coated will also possess the other characteristics of p.t.f.e., in that they will be solvent resistant, non-sticking, unaffected by moisture, self-lubricating, and they will exhibit its remarkable electrical properties.

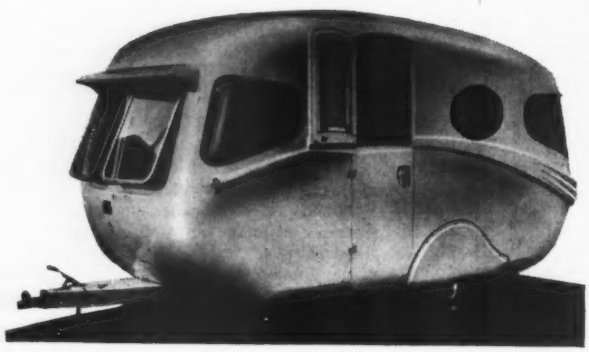


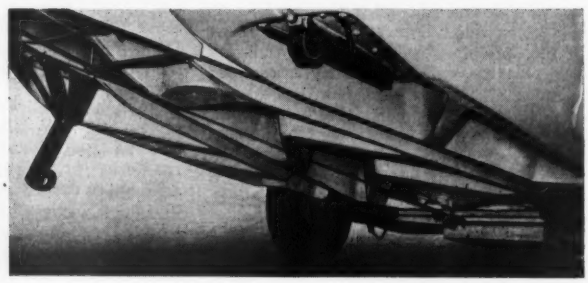
(Top Right) Zip fasteners with plastic yarn woven into the side tapes.

(Centre Right) Two springs which have been coated with p.t.f.e.

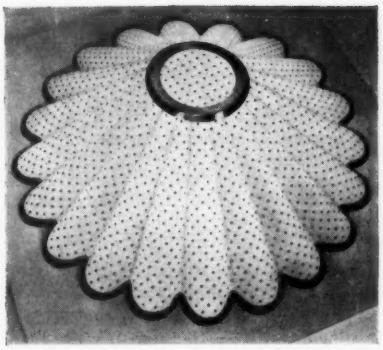
(Right) The United Dairies float which uses glass reinforced polyesters for the body-work.







(Left and Above) The Willerby Vogue caravan which is reported as having the whole outer shell including the chassis (above) moulded in one piece from glass reinforced polyester resin. The interior lining of the van is also moulded from the same material. This is the first caravan to have a chassis constructed in this way.



Light shade made from acetate sheet.

Ceiling Light Shade

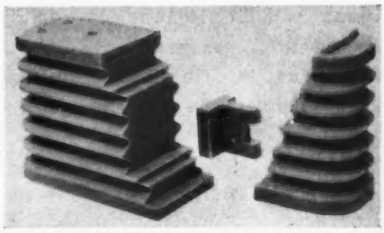
In keeping with the trend towards concealed lighting in the home Modern Lampshades of Luton have introduced an attractive range of ceiling lights.

Made from Celastoid, a Celanese acetate sheet, the shades have welded seams and both edges are wired and bound, the outer edge being trimmed in contrasting fabric.

An ingenious and simple method of fitting, taking only minutes to complete has been incorporated. These washable and durable shades are available in 21 in. and 24 in. diameter and in several screen-printed designs.

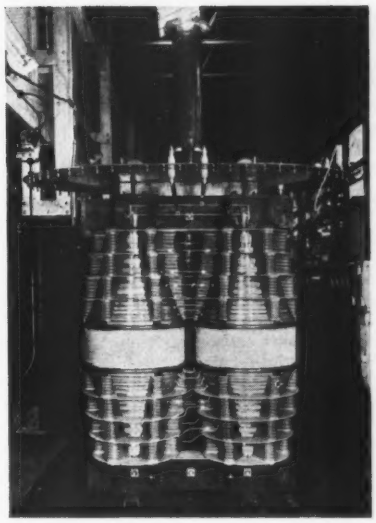
Cast Polyester Blocks for Transformers

Nearly 10,000 separator blocks cast in silica-filled Bakelite polyester resin are being used in the manufacture of 100 high voltage testing transformers destined for the export market. The polyester resin blocks have been specially designed by the manufacturers, Foster Transformers Ltd., South Wimbledon, for locating the winding formers and to ensure rigid clamping. The blocks are spaced equally around the perimeter of the winding formers, one above the other throughout the entire depth of the winding. Their use enables a considerable amount of external support and bracing to be eliminated, thereby appreciably



(Above) The cast polyester blocks.

(Right) The blocks in position on the transformer.



reducing the man hours normally required for assembly, whilst at the same time adding to the efficiency of the design.

The transformer is a 150 kVA, 900/250,000 volt model intended for testing electrical equipment and insulation in power stations.

Apart from its considerable mechanical strength, good electrical characteristics and resistance to the oil used for cooling the transformer, polyester resin has the advantage that the comparatively complex shaped blocks can be cast from it in one operation, thus avoiding the need for further finishing.

Vacuum Formed Radio Facias

Radio facias, vacuum formed in high-gloss Iridon sheet, are now being used by Duple Motor Bodies Limited in their latest coaches.

Iridon is an extruded polystyrene sheet of the Styron 475 type and is manufactured by the Iridon Division of Commercial Plastics Limited, 1 Avery Row, Grosvenor Street, London, W.1.

The vacuum forming is being carried out by Clearex Products Limited, Heather Park Drive, Wembley, Middlesex, using the snap-back technique, which ensures maximum uniformity of wall thickness.

(Right) A Vacuum formed radio facia panel in polystyrene for use in motor coaches. This is a novel application for vacuum forming and suggests another big market for it to enter.

Some New Aspects of Polymer-to-Metal Bonding

(*continued from page* 311)

published results of R. W. Kaercher and G. W. Blum (*Ind. Eng. Chem.* **43**, pp.488–93, 1951) on the Bonding of Butyl Rubber to Brass strongly suggest that it should be possible to bond other elastomers, if they are capable of undergoing a vulcanization reaction with sulphur. There is thus a good prospect of being able to bond other polymers, at present incapable of being bonded to metals, merely by slightly modifying the original monomeric reaction system by the incorporation of a controlled small percentage of a conjugated diene.

If these new co-polymers can be sulphur-cured with the use of suitable accelerators, then the conditions should be favourable for promoting bond formation on several metal surfaces of which alpha brass need only be one. It is therefore within reason, to think of "tailoring" the surface layers of a plastic so as to make it compatible with an evaporated coating of a particular metal. The point has already been made once before, that the actual nature of the tarnishing reagent itself (e.g. the mix undergoing cure) appears to be a non-controlling factor in the mechanism of the sulphide film bond formation, and so long as about 1% of sulphur is present, and some suitable accelerator (or ultra-accelerator in the case of butyl rubber) then the conditions will be favourable for producing a bonding layer. This may prove to be an over-simplification of the problem in practice, but in essentials, the principles of success are beginning to emerge, and as Alstadt says in the article already quoted: "The most promising avenue for future development of adhesives that will have marked strength and environmental resistance, is the synthesis of completely different and unique polymers and cross-bridging agents especially designed for rubber-metal adhesion use."

Acknowledgments

The author desires to acknowledge, with gratitude, his thanks to the Scientific Grants Committee of the Royal Society, for assistance with the purchase of certain pieces of optical equipment used in this research. He also thanks Mr. A. L. Stokoe, B.Sc., A.I.R.I., for expert help in connection with the preparation and handling of all the rubber mixes required throughout these experiments, and Mr. A. J. W. Ring for his never failing help and advice with the construction of apparatus in the workshop of the National College of Rubber Technology. It is also a pleasure to be able to thank Professor G. Wesley Austin for the facilities which have been provided in the University Department of Metallurgy at Cambridge. Finally, acknowledgment is made to Dr. F. H. Cotton, Head of the National College of Rubber Technology, for much valuable help.

Plastics NEWS

Plant and Equipment, Materials Processes, Company News, Technical Literature, Exhibitions, Personal Notes, and Meetings

DIELECTRIC HEATING GENERATOR.—A new, high power dielectric generator unit has just been released by Radio Heaters Ltd. This Radyne electronic unit is designed to be used singly or in batteries feeding on to a conveyorized oven running behind a row of units. Each unit is capable of delivering 45 kW on continuous basis at a frequency of 18 to 20 mc/s. Each unit is therefore capable of removing 120 lbs. of moisture per hour from materials which are difficult to dry any other way.

It is claimed that the new Radyne 45 kW unit is the largest unit of this capacity to be in regular production outside the United States of America.

General

Laboratory Mills and Calenders.—Two catalogue sheets have been issued by International Corporation, Ltd., 1 Cornwall Road, London, S.E.1, showing the range of Berstorff laboratory mills and calenders for whom they are agents. The calender we illustrate is the 450 × 250 mm. four-roll type having a maximum working speed of 25 m/min. This machine has four separate motors, one for each bowl, driving through a separate gear stand and universal couplings. With this arrangement it is possible to vary the speed of each bowl individually and to adjust the friction of each nip within wide limits. Heating of the bowls can be by steam or electricity. Other types of calenders available are a three superposed rolls type and four-roll inverted L type. The laboratory mills range from the 225 × 100K. (9 in. × 4 in.) type powered by a 3 h.p. motor to the 450 × 200K. (17¾ in. × 8 in.) which has a 15 h.p. power consumption. Variable speed models and models in which there is an individual and variable speed drive to each roll are also available.

Cross-linking agent for rigid polyurethane foam.—From Jacobson Van Den Berg & Co. (U.K.), Ltd., 3/5 Crutched Friars, London, E.C.3, comes an announcement of the production by Wyandotte Chemicals Corpn. of Quadrol. Quadrol is a water-white viscous liquid of high purity which is being used in the production of rigid polyurethane foams. Its four hydroxyl groups make it an effective cross linking agent, and it will also accelerate the action of other catalysts. Rigid polyurethane foams with up to 85% closed-cell structure and with a density of 2 lb. per cu. ft. have been prepared.

Filter Equipment.—L. A. Mitchell, Ltd., Harvester House, 37 Peter Street, Manchester, 2, are acting as the sole representatives in Great Britain for the American designed Sparkler horizontal plate filter. These filter units have been specially designed to clarify resins, varnishes and other similar materials containing about 5% solids or impurities. The laboratory unit which is illustrated is made in stainless steel and supplied complete with pump.

New Synthetic Rubber Plant.—The Distillers Company Limited announce that British Geon Limited has begun the erection of a plant to manufacture special purpose synthetic rubbers at Barry, Glamorgan.

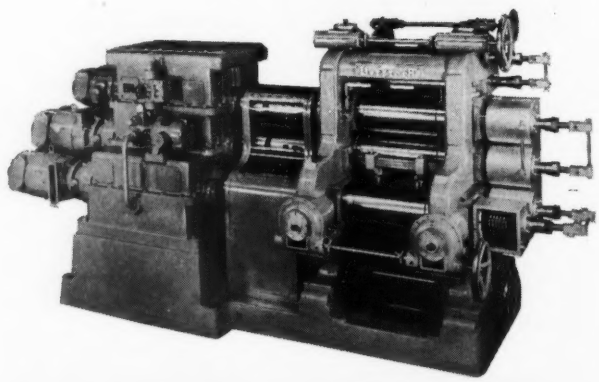
The new plant will manufacture Hycar butadiene/acrylonitrile copolymers and latices usually referred to as nitrile rubbers. The new plant will be located alongside those of British Resin Products Limited, British Geon Limited and Distrene Limited, the three companies comprising the Distillers Plastics Group.

Trade Mission to Russia.—The first trade mission from the British plastics industry to visit Russia left London Airport for Moscow last month. The object of the visit, which is being made at the invitation of the U.S.S.R. Government, is to follow up an exchange of views which took place at the time of the visit to London of Marshal Bulganin and Mr. Kruschev and of the recent trade delegation.

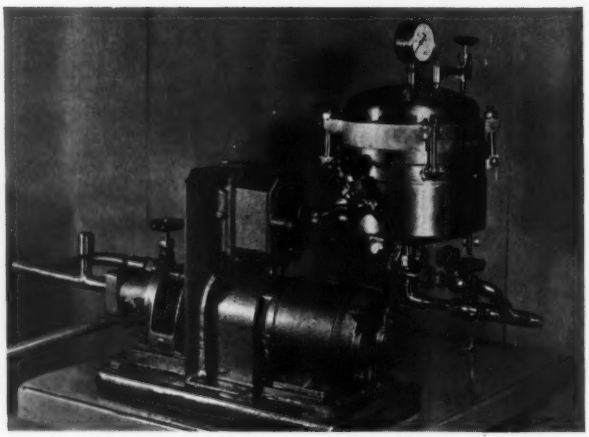
The mission consists of three members of the British Plastics Federation—Mr. Herbert Bridge (British Moulded Plastics Ltd.), Mr. Jack Lesser (Crystalate Ltd.) and Mr. R. Sternberg (Sterling Moulded Materials Ltd.).

New Range of Ultrasonic Transducers.—A new range of transducers for widespread service in ultrasonic projects has just been announced by Technical Ceramics Limited of Towcester, Northants.

The new piezoelectric transducers made by Technical Ceramics Limited, for use in ultra-



(Right) The 450 x 250 mm. (17¾ in. x 9⅞ in.) Berstoff laboratory Calender.



(Above) Laboratory model of the horizontal plate filters.

(Left) The Radio Heaters, Ltd., dielectric heating generator.

sonic generators, are fabricated in ceramic made principally from barium titanate in a polycrystalline form and are impervious to moisture and unaffected by temperature. Ceramic transducers are able to handle high powers and their overall characteristics, such as coupling coefficient, dielectric constant, temperature stability, and sensitivity are generally reported as being superior to those found in other transducer materials.

Polystyrene Sheet. — Monsanto Plastics, Limited announce that Lustrex T-6 toughened polystyrene is now available in sheet form for the vacuum forming process.

Lustrex T-6 sheet is immediately available in thicknesses of 0.030, 0.060 and 0.125 in., but other thicknesses can be provided as required.

Lustrex T-6 may also be obtained in the form of a laminated sheet. This consists of a thin layer of biaxially orientated general purpose polystyrene laminated to the toughened sheet. The laminated surface has a high degree of gloss but imparts a lower elongation at break to the composite material.

Monsanto Plastics Limited do not themselves supply Lustrex T-6 in sheet form, but will be pleased to direct prospective users to suppliers of sheet.

Price Reduction.—Ashdowns Ltd., St. Helens, announce that the prices of Undulite, translucent corrugated plastic sheeting, are to be reduced. The reductions vary according to the size of sheet and the particular profile required, but they average at somewhere between 5% and 10%. The new prices will take effect immediately.

New Polythene Plant.—British Hydrocarbon Chemicals Ltd. (jointly owned by The British Petroleum Company, Ltd., and The Distillers Company, Ltd.) has decided to construct a plant for the production of polyethylene according to the low-pressure process of Phillips Petroleum Company. The plant will be located at Grangemouth, Scotland, and will have an approximate annual production capacity of 11,000 tons.

Association of Management Consultants Formed.—Four British firms of management consultants have formed the Management Consultants Association. The firms are Associated Industrial Consultants Ltd., Personnel Administration Ltd., Production-Engineering Ltd., and Urwick, Orr & Partners Ltd.

The Secretary of the M.C.A. is Mr. F. S. Tuffin and its office is at 4 London Wall Buildings, London, E.C.2 (London Wall 4080).

Plastics Materials Exhibition.—R. H. Cole & Co. Ltd. in conjunction with J. M. Steel & Co. staged, last month, an exhibition of Bayer plastics materials. Three materials were features; Cellidor B, Durethan BK, and Durethan U.

Cellidor B is an acetate butyrate moulding compound possessing a high degree of toughness combined with its excellent colour range and surface finish after moulding. Many fine examples of normal and unusual mouldings in this material were on display and included golf club heads, automobile steering wheels, fountain pen bodies, door handles as well as specialized industrial mouldings.

Durethan BK is a nylon 6 polycaprolactam and has the properties of toughness, shock resistance, and high temperature resistance associated with nylon compounds. Examples of mouldings in Durethan BK included gear wheels, for use on a lawn mower, a crash helmet and a moulded shuttlecock. Other products of this material were foils, pipes, and sintered metal components.

Durethan U is a new polyurethane material of high molecular weight produced from di-alcohols and di-isocyanates. It is similar to nylon in some respects in that it has a high mechanical strength and high melting point (160°–180° C. depending on the grade). In addition it has a low water absorption figure and good electrical properties. Several unusual industrial mouldings in this material were displayed.

During the exhibition technologists from the Bayer Company were in attendance as well as members of the staff of R. H. Cole and in this way full information on any question relating to the materials could be obtained by visitors. As the exhibition is now over inquiries should be sent to R. H. Cole & Co. Ltd., 2 Caxton St., Westminster, London, S.W.1.

Golf Results.—At the P.I.G.S. meeting at Moor Park on October 4 the results were:— "Airborne" Trophy: Winner: F. A. Garrett (5), 34 points. Runner up: P. Smith (6), 34 points (best last 9 holes). Visitors Prize: Winner: H. Ruffle (7), 37 points. "Cyril Last" and "Major Knowles" Trophies: Winners: W. A. Evans (4) and R. G. L. Welham (24), 31 points. Runners-up: T. W. Fassett (15) and L. C. Pendry (22) 27 points. Visitors Prize: Winners: P. Smith (6) and E. S. Clague (9), 27 points.

Impact Polystyrene.—Two new products have been announced by Kleestron Ltd., West Halkin House, West Halkin St., London, S.W.1. The first is an improved grade of polystyrene for injection moulding or extrusion, known as Kleestron Super 44 and is described as Impact Styrene. The second product is Kleestron sheeting which is extruded from the Super 44 material. The sheeting is available in 48 in. widths and lengths up to 96 in. with a thickness range of from 0.015 in. up to 0.250 in.

Anti-Static Compound.—The Swedish principals of Guest Industries, Ltd., 81 Gracechurch Street, London, E.C.3, Liljeholmens Stearinfabriks AB., have produced a quaternary ammonium compound which is an extremely effective anti-static agent. It is supplied in a 50% solution in iso propyl alcohol and is diluted to a 1% solution with cold water. By dipping, a monomolecular layer of the agent is deposited on the article.

Polish Plastics Institute.—An Institute of Plastics Machining, the first in the country, is to be established in Poznan, Poland. It will pay special attention to the use of plastic materials in the metal industries.

Literature

Unpublished Reports.—Summary of Available Data on Radiation Damage to Various Non-Metallic Materials (AEC–KAPL–731). Research on Boron Polymers P.B. 111,689.

Copies can be obtained from The Department of Scientific and Industrial Research, Technical Information and Documents Unit, Cunard Building, 15 Regent Street, London, S.W.1.

E.R.A. Publication.—The British Electrical and Allied Industries Research Association has just released for publication the report (Ref. L/T 344) by A. G. Day on Water Sorption in Heat-treated Polystyrene and Plasticized Polyvinyl Chloride.

Copies of the report can be obtained, price 10s. 6d. postage 6d., from the Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey.

Company News

Borad Ltd.—Last month the British Oxygen Company invited the press to see current goings-on at the Morden site, where British Oxygen Research and Development Ltd. (Borad) has just been formed from the research and development department located there. The visitors were received by Dr. Philip Sykes, chairman of the new company.

Extensive laboratories, and plant installations, serve the five principal departments—basic research, chemical products, gas applications, gas separation, and engineering. Polymer research is an important item on the list of Borad's immediate projects. Dr. Sykes confirmed B.O.C.'s growing interest in the plastics industry, but offered no comment on projected lines of development.

Latymer Engineering Company.—We regret that due to a misunderstanding it was incorrectly stated in the October issue that the above company has been acquired by T. H. and J. Daniels Ltd. The manufacturing and selling rights of the range of Latymer vacuum forming machines and equipment only have been acquired by T. H. and J. Daniels Ltd.

Hellerman Ltd. held an open day at the Crawley, Sussex, factory in October 9. After a reception by Mr. John Bowthorpe, the visitors toured the factory and the new building, and were shown the latest techniques employed by the company in the fabrication of p.v.c. and other plastics materials.

John Kimbell & Co., Ltd., have formed a separate company to handle their machine tool business. The new company, Kimbell Machine Tools Ltd., will operate from their present address at 39 Victoria Street, Westminster, London, S.W.1.

Berite Ltd. announce the production of several new forms of Homebrite decorative plastic laminate. These include, plywood, hardboard, and metal alloy backings. Further details can be obtained from the company at Lammas Road, Lea Bridge Road, Leyton, London, E.10.

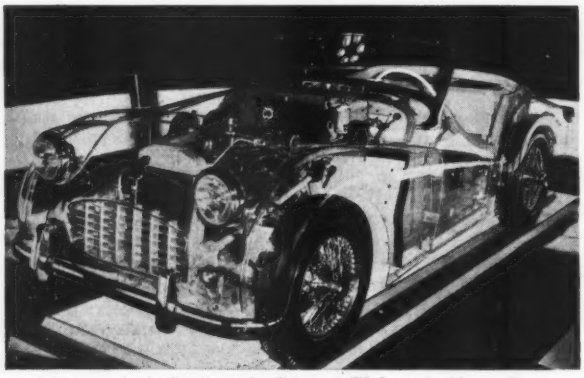
Hellerman Ltd. announce a price reduction in their Hellathene water pipe which is manufactured to B.S. 1972.

George Cohen, Sons & Co., Ltd.—Internal reorganisation in this company has resulted in a new subsidiary being formed to take over the trading activities of the parent company. The subsidiary will adopt the name of the latter. The name of the parent company which now becomes a holding company controlling the group has been changed to The George Cohen 600 Group Ltd.

Union Carbide and Carbon Corporation has agreed to acquire all of the business and assets of The Visking Corporation on a basis that will provide to the stockholders of Visking one share of Union Carbide stock for each 2½ shares of Visking. Completion of the transaction requires approval at a meeting of Visking stockholders.

Johnson Matthey & Co., Ltd., announces its appointment as sole United Kingdom agents for the sale of Mercadium Pigments, produced exclusively by Imperial Paper & Colour Corporation, New York, U.S.A.

G. V. Planer Ltd. have moved to their new premises at Windmill Road, Sunbury-on-Thames, Middlesex, Tel. Sunbury-on-Thames 2266, where considerably extended facilities are available.



A Perspex body fitted to the Triumph TR.3 at the Motor Show last month.

The stand of Scobel, a local manufacturer of reinforced polyester sheets, at the Ghent International Fair.

Inc., to build and operate a privately owned nuclear reactor for industrial research in atomic energy, at Plainsboro, New Jersey, U.S.A.

Permali Ltd.—Over 200 guests were present at the laying of the foundation stone of the new factory for Permali Ltd. now being erected at Gloucester.

The ceremony was performed by the Right Reverend the Lord Bishop of Gloucester in the presence of the Civic dignitaries and representatives from local educational, technical and industrial organisations.

The building development, covering some seven acres of land adjacent to the Company's original premises at Gloucester, is being undertaken by C.A.S. (Industrial Development) Ltd. and completion is expected by September, 1957.

British Titan Products Co., Ltd., is to extend its production facilities at Grimsby at a cost of more than £2m. These extensions, which are due to be completed during 1958, will raise the production at Grimsby to 70,000 long tons a year.

Turner & Brown, Ltd., chemical plant engineers of Bolton, announce that in association with Matthews & Yates, Ltd., fan engineers of Swinton, Manchester, they have re-designed and extended their range of p.v.c. fans.

Exhibitions

Protective Clothing and Safety Exhibition.—The first Protective Clothing and Safety Equipment Exhibition will take place at the Empire Hall, Olympia, from May 13 to 17, 1957.

The exhibition will be a complete display of all types of industrial clothing and safety wear, including overalls, headwear, facewear, gloves, etc., available to every trade and industry.

A shell stand scheme has been planned for the whole exhibition which will ensure the attractiveness of the display. The organizers are U.T.P. Exhibitions, Ltd., 43 Gerrard Street, W.1.

Radio and Electronic Component Show.—The 14th annual exhibition organized by the Radio and Electronic Component Manufacturers' Federation is to be held at Grosvenor House and Park Lane House, Park Lane, London, W.1, from Monday, April 8, to Thursday, April 11, 1957.

Formerly known as the Radio Component Show, the title has now been changed to Radio and Electronic Component Show to be more descriptive of its scope, covering as it does components for the radio, television, telecommunications and electronic industries in their widest aspects.

Next year 160 manufacturers are expected to exhibit, and this has necessitated holding it in two sections which, however, are close together and will be organized and operated as a single exhibition.

For overseas visitors and other special guests a preview is being held from 10 a.m. to 2 p.m. on the first day, April 8. Admission is by ticket obtainable from the Secretary, R.E.C.M.F., 21 Tothill Street, Westminster, London, S.W.1.

Conferences

Oil and Colour Chemists' Association Conference 1957.—The Association's biennial Conference will take place at Torquay from May 21 to 25, 1957, with headquarters at the Palace Hotel, at which the technical sessions will be held.

The provisional title of the Conference is "Catalytic Processes relating to the Surface-Coating Industries," and Mr. P. J. Gay, B.Sc., the Honorary Research and Development Officer of the Association, reports that the following have promised to contribute papers: Professor D. D. Eley, of Nottingham University; Dr. G. C. Bond, of Hull University; Dr. D. F. Rushman, of the Paint Research Station; Mr. R. R. Coupe, of the Printing, Packaging and Allied Trades Research Association, and a paper by a member of the Shell Chemical Company. Other papers dealing with driers and resin polymerization are envisaged. Mr. Gay would be very pleased to hear from any person engaged in the paint industry, who wishes to contribute a paper on this topic, and all such enquiries should be directed to Mr. Gay, at Hangers Paints, Ltd., Stoneferry Works, Hull.

Non-members wishing to receive details, when published, of accommodation, social activities, etc., should write to Mr. R. H. Hamblin, M.A., General Secretary, Oil and Colour Chemists' Association, Memorial Hall, Farringdon Street, London, E.C.4.

Welding Conference.—A list of papers to be presented at the Welding Conference to be held from June 17 to 29 is now available and can be obtained from The Secretary (C.W.C.), The Institute of Welding, 29 Park Crescent, London, W.1.

Personal

Mr. G. E. Godfrey has resigned his position with the Dunlop Rubber Co., Ltd., to take up an appointment with Silvertown Rubber Co., Ltd. He is to join the Board, and will be located at Herga House, Vincent Square, London, S.W.1.

Mr. B. D. Garware, of Dominion Plastic Industries, Bombay, was unanimously elected as President of the All India Plastics Manufacturers' Association at the recent Annual General Meeting.

Dr. D. M. Young has been appointed associate technical director of Union Carbide Development Company, a Division of Union Carbide and Carbon Corporation.

Mr. J. A. Dewhirst and **Mr. P. H. Ogden** have been appointed Local Directors of George Cohen, Sons & Co., Ltd., the newly-formed trading subsidiary of the George Cohen 600 Group Ltd.

Mr. V. W. Dale.—The Council of the British Electrical Development Association announce with regret that Mr. V. W. Dale, Companion I.E.E., will relinquish his position as director and secretary of the Association as soon as his successor has been appointed and ready to take over.

Mr. Dale, who is approaching the completion of 50 years in the Electricity Supply Industry, is retiring on account of health considerations.

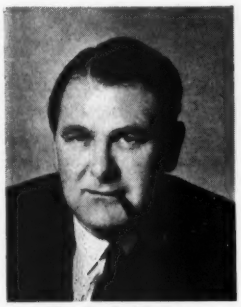
Mr. A. Knowles, manager of the Wembley works of British Oxygen Gases Limited, has been appointed technical manager, Acetylene, at the Company's headquarters at Bridgewater House.

He takes over the position formerly held by **Mr. E. A. Groom,** who is taking up an appointment with the parent organisation, the British Oxygen Company, Ltd.

The new district manager at Wembley is **Mr. D. R. Harris,** formerly assistant production manager at the Head Office, British Oxygen Gases.

Mr. R. Q. Marris has been appointed a director of Lion Electronic Developments Ltd.

Mr. R. Q. Marris.



Mr. B. T. Francis.

Mr. R. J. Chilvers.

Mr. H. J. Fussell.

Mr. C. F. Huebner, chief buyer for the British Oxygen Company Limited, has been elected Chairman of the Purchasing Officers' Association.

Mr. R. J. C. Bryce has been appointed district manager of the Scottish Division of British Oxygen Gases.

Sir Hugh Beaver.—At its meeting on October 10 the Grand Council of the Federation of British Industries elected Sir Hugh Beaver as Deputy President.

Dr. J. G. Mackay, whose resignation as Works Director of the Avon India Rubber Company, Limited, has just been announced, has joined the Board of Francis Shaw & Company, Limited, Corbett Street, Manchester, as Technical Director.

Mr. J. Hayward, managing director of Polythene, Ltd., is offering to his European customers an on-the-spot service. By piloting his own aircraft he can reach any of his customers within a very short time of their contacting him.

Mr. B. T. Francis, has been appointed Sales Manager, Moulding Material Sales Department, of Bakelite, Ltd. He is responsible to Mr. P. Smith, General Sales Manager of the Company.

Mr. R. J. Chilvers becomes Chief Area Representative, Midland Area, Moulding Material Sales Department, and **Mr. H. J. Fussell** has been made Chief Area Representative, Southern Area. Both are responsible to Mr. Francis.

Mr. R. O. Shaw.—It is with regret that we hear of the death of Mr. R. O. Shaw, 47, Joint Managing Director of Francis Shaw & Company, Limited, as the result of a motoring accident.

Mr. Shaw joined Francis Shaw & Company, Limited, in 1928 as Assistant Works Manager. He was appointed Joint Managing Director in 1954 and founded a subsidiary company, Francis Shaw (Canada), Limited, at Burlington, Ontario.

Mr. Shaw leaves a widow and two daughters.

Mr. R. O. Shaw.

Meetings

November

16th.—" Progress in Plastics," M. C. Dixon. Plastics Institute, Midlands Section, The James Watt Memorial Institute, Birmingham. 6.30 p.m.

16th.—Dinner and Dance. Plastics Institute, South Wales and Monmouthshire Section, St. Mellons County Club.

17th.—Ninth Annual Dinner and Dance, Incorporated Plant Engineers, Waldorf Hotel, Aldwych.

19th.—" Some Aspects of the Shaping of Acrylic and P.V.C. Rigid Sheet," J. M. J. Estevez, B.Sc., A.R.I.C., and D. C. Powell, B.Sc. Plastics Institute, London Section, The Lecture Hall of the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1. 6.30 p.m.

21st.—" Melamine Resins and their application," Plastics Institute, North-Eastern Section, Second Dining Room, Eldon Grill, Grey Street, Newcastle. 7 p.m.

23rd.—" Some Aspects of Cross Linking and Related Reactions in Relation to the Physical Properties of Polymers," H. S. Lilley, B.Sc. Birmingham Paint Varnish & Lacquer Club, Queens Hotel, Birmingham. 7 p.m.

26th.—" Electronics in Industry," F. G. Totty. Incorporated Plant Engineers, West and East Yorkshire Branch, Leeds University. 7.30 p.m.

29th.—" Automation." Incorporated Plant Engineers, Sheffield & District Branch, Grand Hotel, Sheffield. 7.30 p.m.

30th.—" Polyurethane Resins," R. B. Waters, M.Sc., Ph.D., and W. Abbotson, B.Sc. Plastics Institute, North-Western Section, Engineers' Club, Albert Square, Manchester, 2. 6.45 p.m.

December

3rd.—Chairman's Lecture. Plastics Institute, London Section, The Lecture Hall of the Royal Society of Tropical Medicine and Hygiene, 26 Portland Place, London, W.1. 6.30 p.m.

3rd.—" Extrusion Problems," S. W. Trill. Plastics Institute, Midlands Section, Grand Hotel, Leicester. 6.45 p.m.

5th.—" Application of Plastics in Industry," C. L. Child. Incorporated Plant Engineers, Southern Branch, Polygon Hotel, Southampton. 7.30 p.m.

5th.—" High Impact Polystyrene," Peter Brown. Plastics Institute, North-Eastern Section, Second Dining Room, Eldon Grill, Grey Street, Newcastle. 7 p.m.

6th.—" Some Recent Investigations of Polymer Degradation Processes," Dr. N. Grassie. Plastics Institute, Southern Section, Chemistry Department, The University, Southampton.

6th.—" The Pigmentation of Wash Primers," V. Watson, B.Sc., and H. F. Clay, A.R.I.C., A.M.I.Chem.E. The Birmingham Paint Varnish and Lacquer Club, Imperial Hotel, Birmingham. 6.30 p.m.

7th.—Sixth Annual Dinner and Dance. Plastics Institute, Western Section, The Queen's Hotel, Cheltenham. 7 for 7.30 p.m.

10th.—" Some Problems in the Colouring of Plastics," C. Musgrave. Society of Chemical Industry, Plastics and Polymer Group, S.C.I. Meeting Room, 14 Belgrave Square, London, S.W.1. 6.30 p.m.

10th.—" Combustion "—film and discussion. Incorporated Plant Engineers, Dundee Branch, Mathers Hotel. 7.30 p.m.

10th.—" The Plant Engineer's Approach to Materials Handling." Joint Meeting of Incorporated Plant Engineers, Glasgow Branch, with the Institute of Materials Handling at the Institution of Engineers and Shipbuilders. 7.15 p.m.

10th.—" Cellular Rubber and Plastics," M. A. Bolger. Plastics Institute, South Wales and Monmouthshire Section, joint meeting with Institute of Rubber Industries. Kings Head Hotel, Newport. 7 p.m.

12th.—" Electrical Installations—Should they be Officially Tested; if so, by Whom?" L. A. B. Lowe, A.M.I.Plant.E. Joint meeting of Incorporated Plant Engineers, East Midlands Branch, with the Leicester Branch, The Sherwood Room, County Hotel, Theatre Square, Nottingham. 7 p.m.

" Plastics in the Service of Man "

The following is a list of full names and addresses of companies mentioned in the illustrated feature, " Plastics in the Service of Man," which appears on pages 304 to 306 in this issue:—

69. " Plastics in the Nursery "—2

Airfix Products, Ltd., Haldane Place, Garratt Lane, London, S.W.18.

B.X. Plastics, Ltd., Higham Station Avenue, Chingford, E.4.

Bejoss, Ltd., 13 Ingestre Place, London, W.1.

Combex, Ltd., Ganton House, Ganton Street, London, W.1.

Cow, P. B., & Co., Ltd., 12 Hay Hill, Berkeley Square, London, W.1.

Cumbrian Mouldings, Ltd., Maryport, Cumberland.

Dean's Rag Book Co., Ltd., High Path, London, S.W.19.

Injection Moulders, Ltd., Westmoreland Road, The Hyde, London, N.W.9.

Kleeman, O. & M., Ltd., West Halkin House, West Halkin Street, Belgrave Square, London, S.W.1.

Kleinert Rubber Co., Ltd., Walpole House, 87/91 New Bond Street, London, W.1.

Projects (Coventry), Ltd., Rockland Works, Eagle Street, Coventry.

Randall, J. & L., Ltd., Merit House, Cranborne Road, Potters Bar, Middlesex.

Raywarp Textile, Ltd., Alfred Street North, Nottingham.

Robinson & Sons, Ltd., Wheat Bridge Mills, Chesterfield.

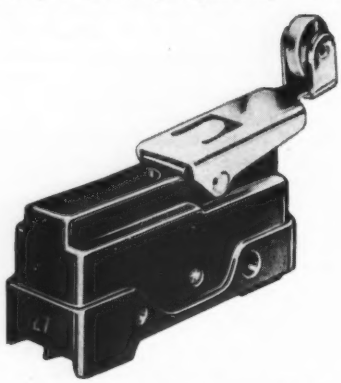
Velbex—B.X. Plastics, Ltd., Higham's Station Avenue, Chingford, E.4.

Vogue Playthings, Ltd., Egerton Road, Melton Mowbray, Leicestershire.

Automation Equipment

Micro Switches.—A new range of 30 micro switches having a common movement with different actuators has now been added to the Pye range of switches. The switch movement consists of a moving contact arm, leaf spring, and operating trigger or rocker assembled on to a base moulding complete with a setting device. The travel of each switch is set individually to 0.016 in. ± 0.0005 in. thus enabling each switch to trip at the same point on repeated operations. The rating of the switch is 5 amps at 250v. A.C. and 12v–29v. D.C.

Pye Ltd., Pye Switch Division, Otehall Works, Station Road, Burgess Hill, Sussex.



Automatic Proportioning System.—A new system of fully automatic feeding, weighing, and discharging whereby all operations are centrally controlled is being manufactured and distributed by Henry Simon Ltd. Known as the Select-O-Weigh Automatic Proportioning System it will handle up to 12 different ingredients for one mix accurately proportioning and weighing each before the next is fed into the hopper. Demonstrations and further information can be obtained by contacting Mr. C. R. Hicks.

Henry Simon Ltd., Cheadle Heath, Stockport, Cheshire.

Single Channel Thickness Gauge.—The Ekco Type N565 Nucleonic Thickness Gauge is a single - channel instrument comprising a measuring head and an indicator unit with a built-in adjustable balancing-voltage source, which can be calibrated directly in any required weight or thickness units.

An important feature of the instrument is its extremely good stability. This is due to the use of a vibrating reed electrometer, which avoids most of the well-known disadvantages of the D.C. Amplifier normally used. Additionally the power unit is electronically stablised, to eliminate the effects of input power supply variations. The only component in the indicator unit which is significantly affected by temperature variations is the Input Resistor, and to eliminate error from this source its temperature is held to within 0.1°C. by means of a thermostatically-controlled oven.

The controls consist of a meter switch which also allows the meter to be used for setting up and circuit checking; a sensitivity control which is a 29 position switch enabling the full-scale deflection of the meter to equal the desired deviation; a response time control with a variation of from 0.25 sec. to 30 sec.; a recorder switch and recorder control; a weight setting control which is a 10 turn helical potentiometer directly coupled to a drum scale with an effective length of 100 in.; and a decay control and switch to compensate for the natural decay of the radioactive source.

Various sizes of measuring heads are available.

A double channel thickness gauge is also being produced which measures the material concerned by comparison with a standard sample.

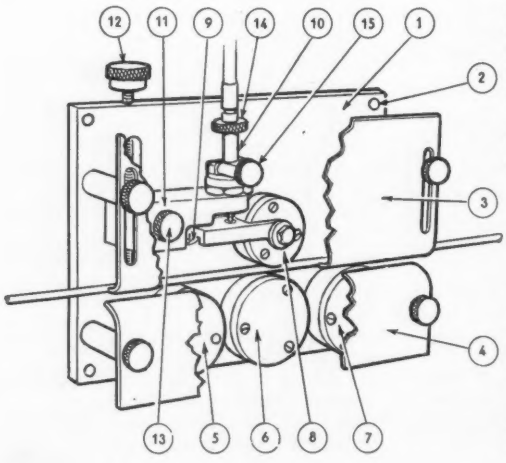
E. K. Cole Ltd., Ekco Works, Southend-on-Sea, Essex.

Continuous Measurement of Insulated Wires and Cables.—The Solex roller wire gauge has been designed to provide a continuous method of checking the diameter of extruded insulated cable or wire. Although it is not intended as a high precision measuring instrument it does have an accuracy of ± .005 mm.

When the instrument is in service the wire passes over the three lower rollers, the centre one of which is placed slightly higher than the other two to ensure that permanent contact between the roller and the wire is maintained. A fourth roller, the measuring roller, is fitted at the extremity of a flexible blade and maintains a continuous contact with the wire as it passes over the central roller. Any variation in the diameter of the wire is transmitted by this roller to the comparator unit by means of an air control valve. Thus changes in diameter influence the air pressure and result in a variation in the liquid level in the manometer tube. The graduated scale provides means of measuring such variations.

The gauge will measure a diameter up to 30 mm. at speeds of up to 300 meters per minute. Special care has been taken to provide simple but accurate means of setting and give the gauge a robust construction entirely suitable for continuous operation under normal working conditions. A compressed air supply is necessary for the operation of the gauge. The complete unit is manufactured by Solex (Gauges), Ltd., who are represented for this particular piece of equipment by Warbrick (Engineering Specialties), Ltd., who will supply further details on request.

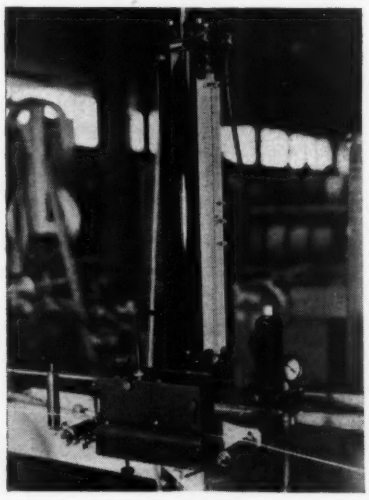
Warbrick (Engineering Specialties), Ltd., Barclays Bank Chambers, Sankey Street, Warrington, Lancs.



(Right) The wire gauge in operation.

(Left) Diagram of parts.

1. Supporting plate.
2. Fixing holes.
3, 4. Protection cover in 2 halves.
5, 7. Guilding rollers.
6. Reference roller.
8. Measuring roller.
9. Flexible blades.
10. Comparator unit 10 M.
11. Feeler group.
12. Regulating screw for feeler group.
13. Locking screw for feeler group.
14. Regulating button for comparator unit.
15. Locking button for comparator unit.



TALKING SHOP . . .

Silver Jubilee.—A dinner and ball was held at the Savoy Hotel, London, on October 25, to mark the Silver Jubilee of the Plastics Institute. The chair was taken by Mr. J. L. Daniels, the President.

The health of the Institute was proposed by Mr. T. F. Clarke, Master of the Worshipful Company of Horners. Those who have heard him speak before will be familiar with the ebullient style, the polished shaft, and the underlying sincerity. Tom Clarke did us well.

Mr. Cyril Last replied, and this must have given him great pleasure; as the first chairman of the Council, and Founder President of the Institute, he, and others present who number the small band responsible for the Institute's beginnings, were surely moved to feel that their baby was celebrating its 25th in royal style. Mr. Harold Lusty proposed the health of the guests, and Mr. C. L. G. Fairfield responded.

Before the dancing commenced, Mr. Daniels presented Mr. Arnold Sherwood with a most elegant silver candlestick, in recognition of his 25 years of service as Honorary Treasurer. As one mordant wit was heard to observe, we have Arnold with us for at least another 25 years, for he won't give up till he has the other candlestick to make the pair.

The dinner was excellent, the band was excellent; a happy occasion, and one was very pleased to see so many faces from the provinces, with us in London to celebrate a very worthwhile occasion.

* * *

Junior Lecture.—Mr. M. D. Curwen delivered the first of two "Junior" lectures arranged for the 1956/57 session of the London Section of the Plastics Institute, on October 17. His paper, entitled "Metallic Soaps as Raw Materials," was designed to teach the younger chemists and technologists in the industry something about an important group of materials having application in almost every branch of chemistry and engineering. As an authority on metal soaps, Mr. Curwen spoke easily, lacing the more solid slabs of chemistry with discursive insights into the practical applications of these materials.

This meeting was held at the National College. The next, a talk on moulding by Mr. J. Butler, will be at the Borough Polytechnic, and both lectures underline the experimental approach to the younger Institute member, much to be commended, by the London Section.

* * *

Gertrude L. Thebaud. An inner glow of acute satisfaction fills me as I write these notes, of which the two photo's below are the subject. I have become a shipbuilder.

The original Gertrude L. Thebaud was built at Essex, New York, designed as a Grand Banks fishing schooner, and today sails under the Venezuelan flag. My version was built in London, and took three weekends to complete. Twenty inches in length overall, she is a joy to look at, and O. and M. Kleeman Ltd., are herewith congratulated on a fine moulding job. So well designed are the component parts that none of my friends will believe her to be home-constructed. The various tools embody well over a hundred cavities in total, and all the mouldings are in Kleestron high impact polystyrene. The vessel is being sold as a constructional kit under the Kleeware tradename.

* * *

Dunlop Close Plastics Department. A note in the *Birmingham Mail* for October 13, states that the plastics department at the Fort Dunlop plant of The Dunlop Rubber Company is to be closed. Fifty operatives and 15 staff will be transferred to other work. My query: is the company making a graceful exit from the plastics sheeting industry, or is production to be moved elsewhere?

* * *

Off to Africa. Harold Langshaw leaves the National College of Rubber Technology shortly to take up a new post as Senior Technical Officer with the South African Bureau of Standards. The Bureau's functions include research, the provision of testing facilities, and the inspection of articles bearing the Bureau's certificates. It is located in Pretoria.

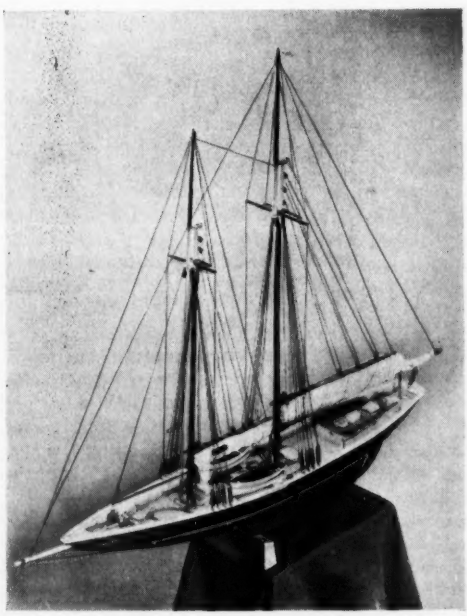
Mr. Harold Langshaw.

Married, with one son, Mr. Langshaw came to the National College specializing in rubber and plastics latex. Prior to that he had worked with Revertex Ltd. as a technical service chemist, and graduated with a B.Sc. in 1948. Both in teaching and in research, he has established at the College a strong reputation in the latex field, and his zestful approach to his function as a lecturer will be greatly missed. Good fortune to him in his new job in the Union.

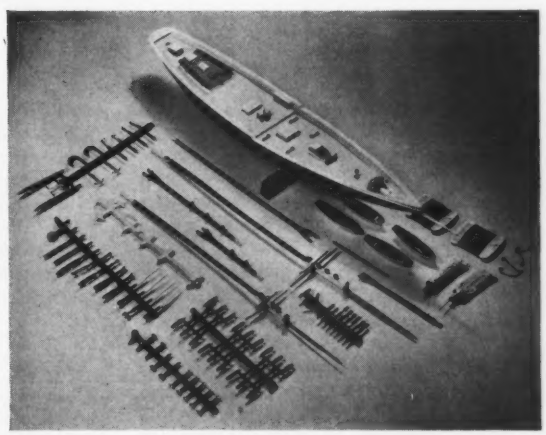
* * *

Production. According to Board of Trade figures, we are still on the growth curve, but not rising quite so fast. U.K. output of plastics materials for the first half of this year was 4% up on the same period for 1955. Individual figures:—**up,** polythene 30%; p.v.c. 5%; polystyrene 11%; **down,** cellulose acetate 7%; phenolics and cresylics 6%.

PLASTIKON.



(Left) The Gertrude L. Thebaud complete. As the photo shows, the rigging is remarkably detailed for a model of this kind.



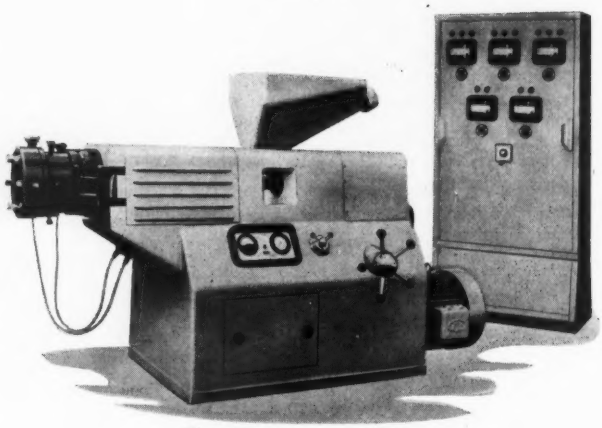
(Right) This photo was taken during construction. The decking and some of the superstructure had been placed in position. Most of the painting was done whilst the mouldings were still attached to thes prues, for simplicity.

Machines for the Industry

A Continental Twin-Screw Extruder

RECENTLY introduced from the continent by John Kimbell & Co. Ltd., of 39 Victoria Street, London, S.W.1 is the AZ twin-screw extruder type E.G.-90-Z. This extruder has been developed by Abegg & Co. Ltd., of Zurich, and Hans J. Zimmer, of Frankfort/M, Germany, with the close co-operation of Symalit Ltd., one of the leading pipe manufacturers of Switzerland. It has already undergone proving trials of a severe nature and has not been found lacking in any requirement so that its introduction in Great Britain is as a well-tried unit of known capabilities, and not as an experimental prototype.

It contains several interesting features which will commend themselves to the extruder. Primarily, as already mentioned, it is a twin-screw extruder but it also has a comparatively long barrel incorporating additional mixing and compounding sections deemed necessary for the working of hard p.v.c. and high-molecular weight polythene. A constant feed to the barrel is obtained by means of a screw thus ensuring a correct volume of pre-compressed powder in relation to the extruder screw speed and type and form of plastics used. The third point of particular interest is the heating and cooling unit. Heating is by induction heaters, automatically controlled to cut in a cooling unit should the frictional heat when working the material become excessive.



The AZ twin-screw extruder.

Working Details

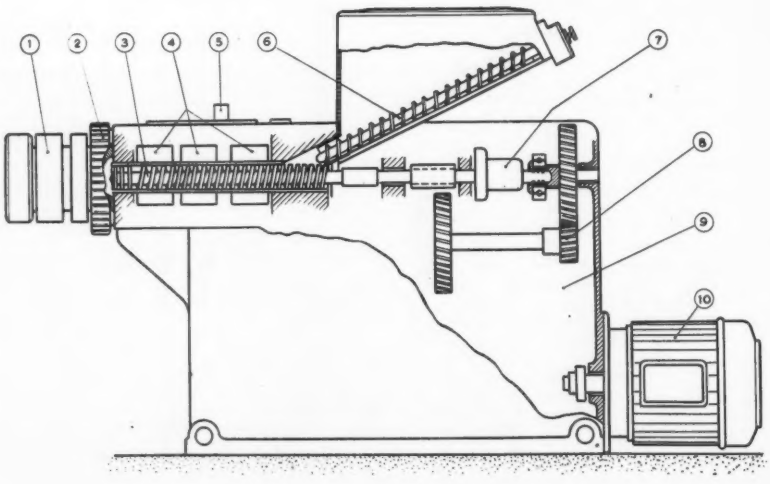
Power for the AZ Extruder is supplied by a 20 h.p. two speed electric motor. The motor is coupled to the reduction gear and gear box of the machine which will give four different speeds, thus eight screw speeds are obtainable. These are 5, 10, 13, 16, 20, 26, 32 and 40 r.p.m. The gear box is also fitted with two double clutches which allow a speed change to be made without stopping the machine. Speed control is effected by means of the screw shift lever on the side of the machine. Lubrication of the gears is by an oil pressure system.

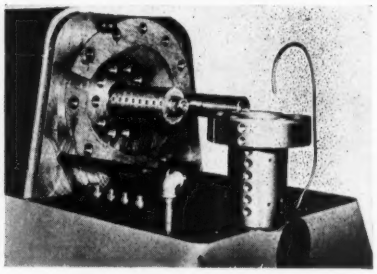
In order to absorb the high back pressures generated by the working of the screws, specially designed thrust bearings have been fitted. The main screw drive is equipped with a roller thrust race of an extra large size while the second screw has, due to lack of space, a collar thrust bearing. Lubrication of the bearings is by a forced oil pressure greasing system.

The twin screws are manufactured from nitrided steel and bored for water or air cooling. The design of the screws is such that there is a progressive pitch in the first zone giving a compression on the raw material in a ratio of 1:3. At the ends of the screws a notched disc pattern is adopted to provide thorough mixing and compounding of the material.

The barrel of the extruder is an alloy steel forging in which a figure of eight bore is made to accept the twin screws. The bore is fitted with nitrided steel liners. Both barrel and screws can readily be removed from the extruder to facilitate cleaning. Heating as already mentioned is by the induction method, three zones being provided on the barrel, one on the adaptor and one on the die-holder. To compensate for overheating due to friction a cooling system is incorporated in the wall of the barrel, operating automatically by means of solenoid valves. Between the first and second heating zones of the barrel a removable gas exhaust chimney is fitted.

The adaptor and die-holder are fixed to the barrel by means of a hinged bayonet-type lock which provides a positive closure

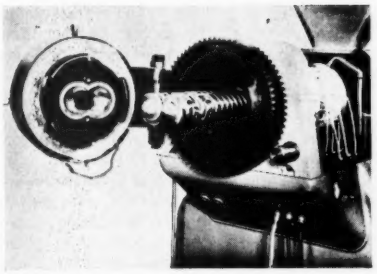




(Above) The collar thrust bearing of the secondary screw. The main screw is fitted with a roller thrust bearing.

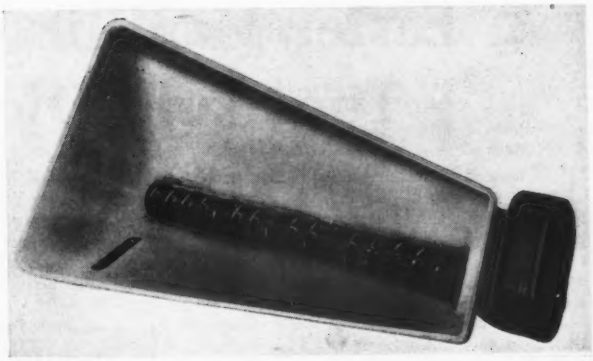
KEY TO DIAGRAM.

1. Die Holder with induction heating.
2. Bayonet-type closure.
3. Screws.
4. Heating coils (induction heating).
5. Chimney.
6. Feed Screw.
7. Thrust Bearings.
8. Reduction Gear.
9. Gear Box.
10. Drive Motor.



(Left) The head assembly with the two screws partly withdrawn. The notched discs at the ends of the screws can be seen.

(Right) The feed hopper and feed screw assembly.



and seal. The standard die-holder will accommodate all dies for the manufacture of pipe up to 8 in. in diameter.

A unique feed hopper of large capacity is provided with the AZ extruder. Designed in the shape of a trapezoid it will hold approximately 100 lbs. of material and has fitted a feed screw thus preventing bridging of the material. The feed screw is coupled to the main drive of the extruder and has an infinitely variable speed obtained through a PIV variable speed drive.

Output

The output of the extruder depends on the type of material and the diameter of the die. The figures quoted are for rigid p.v.c. in powder form. Higher output is reported when granules are used.

Manufacture of granules	440 lb. per hour.
Manufacture of piping—	
3 in. diam. $\frac{1}{4}$ in. wall thickness ..	308 lb. per hour.
1 in. diam. $\frac{1}{16}$ in. wall thickness ..	90–110 lb. per hour.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

The Borough Polytechnic

SIR,—Now that the new session has commenced with an enrolment of over 100 students in our various part-time and full-time plastics courses, I would like, as the new Principal of the Borough Polytechnic, to thank individuals and groups in the Plastics Industry who have contributed so much to the success of our endeavour in the past few months and indeed over the many years that have elapsed since 1931 when the pioneer courses in Plastics were first provided in this Polytechnic. These courses were, so far as we know, the first to be organized by any educational institution in the United Kingdom.

With the support of the industry, we propose to continue and develop our present work preparing candidates for the Associateship of the Plastics Institute and other examinations and to provide such courses that may be necessary in both the chemical and engineering aspects of Plastics.

The Polytechnic has the advantage of a strong Advisory Committee on Plastics including representation of various bodies and not least, of the Plastics Institute. We are most grateful to all members of the Committee for their support and for the help that they have given, and are giving to the Polytechnic in its efforts to develop and extend the senior work in Plastics Technology. We believe that members of the Plastics Institute as a whole, may be pleased to know of the activity of London members in the field of education.

Any note regarding Plastics Technology at the Polytechnic would be incomplete if it did not include our thanks to the Trustees of the Plastics Industries Education Fund for the generous annual contribution to provide bursaries, and to the equipment firms who continue to provide us with valuable items which could not be bought out of the general funds of the Polytechnic. In this latter connection, it has been established recently that the replacement value of Plastics equipment at the Polytechnic is of the order of £100,000.

JAMES E. GARSIDE.
Principal,
Borough Polytechnic, London, S.E.1.

Plastic Building Partitions

SIR,—With a view to bringing eventual alterations to the internal setup of our premises in the way of plastic or laminate partitions, our Company would be interested to check which are the present possibilities offered by the most progressive English manufacturers in this line.

We would therefore much appreciate it if you could let us have the addresses of the leading manufacturers in England who would be likely to send us every information about the above-mentioned materials for following purposes.

Workshop partitions.
Office partitions.
Private flat partitions.

As a matter of fact, we would be interested in such materials (plastics, laminates, or any other material intended for use instead of casual brickwalls), as far as they are sound and their prices rather competitive (we would also appreciate receiving price-lists, if available).

In this connection, we would be much obliged to you if you could mention, on the requested list of addresses, the usual products in which such Firms have specialized.

B. DALMAS.
c/o Cie Electro-Mecanique,
37 rue du Rocher, Paris 8e.

Telcothene Jets

SIR,—With reference to the letter from Griffin & George, Ltd., which appeared in your October issue, we feel that your readers may get quite the wrong impression of our handling of the enquiry for Telcothene injection moulded jets.

Upon receipt of the original enquiry we offered to quote for the jets together with the appropriate tool costs, but we were told by the enquirer that, as the present demand for jets was not likely to be repeated in the forseeable future, it would seem that it would be rather an expensive matter to produce the required jets, and we were accordingly asked to return the samples.

THE TELEGRAPH CONSTRUCTION & MAINTENANCE COMPANY, LTD.
Mercury House,
Theobald's Road, London, W.C.1.

Adhesive Tape

SIR,—We are interested in the possibility of using an adhesive tape for binding the edges of wire screens, and would appreciate any advice you can give.

A very strong bond is required. It would seem, however, that the average self-adhesive tape is not good enough in this respect, and we are willing to consider vulcanizing or heat-curing provided this is easily and quickly applied.

We would appreciate it if you could suggest likely manufacturers of tape.

HENRY SIMON, LTD.
Cheadle Heath, Stockport.

(EDITOR'S NOTE: We cannot understand the function of the tape here. If it is to avoid the nuisance of, or scratching by the end of the wire, then we suggest dipping the edge of the screen in a p.v.c. paste followed by heat curing.)

Easier Handling of Tools and Dies

THE handling and transporting of heavy and awkwardly shaped dies and tools from the toolroom to the press or moulding machine can be considerably simplified with the latest addition to the Matling range of mechanical handling equipment. This is the T-P Tool and Die Handler which has been developed by Matling Ltd., in association with Talbot-Ponsonby & Co., Ltd., and is a pedestrian controlled battery or A.C. mains powered lift truck incorporating a special feature known as the Talbot-Ponsonby pull on/push off attachment.

This feature enables one operator to manipulate the heavy dies and tools from the rack or press on to the die handler and vice versa. The pull on/push off attachment is controlled by an 8 in. crank applied either side of the machine. The cranking movement is transmitted through a gear box to special conveyor chains which move the load to or from the edge of an elevating table from which it can be moved on or off with a bar and chain. The dimensions of the standard table are 34 in. wide by 32 in. long and the unit can be supplied with capacities of up to 3 tons with a lift height of 53 in. or to suit the particular application.

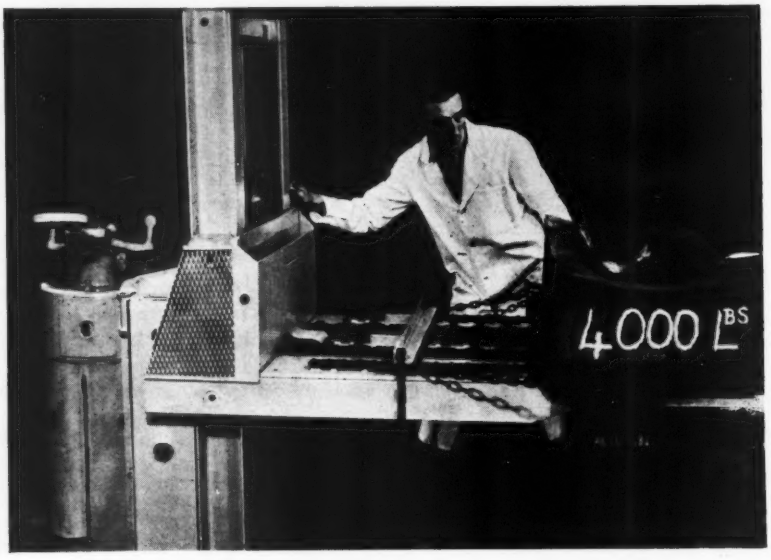
The controls are simple to use and foolproof in operation. The standard Matling power unit is employed which incorporates the usual safety devices. These include a restrictor in the ram outlet in case of hydraulic failure and a pressure relief valve which blows off if the operator attempts to lift a load of excessive weight. The conveyor chains are locked at all times except when the crank is operated.

The hydraulic tank, pump and valve which raise and lower the table by means of a Matling hydraulic jack are integral with the power unit.

The efficiency of the equipment can be gauged by the fact that with it in one instance, one man and the machine operator can carry out in 15 minutes a task that used to take four men two hours to perform by the usual method. Further, it facilitates the storage of large tools in racks, access being necessary on one side only, thus saving floor space.

The machine is of compact dimensions, the battery model having a length of 64 in. and the mains model 57 in. The width and height of both models are 34 in. and 68 in. respectively. The total weight is 18 cwt. 2 qrts. (including batteries).

Further information may be obtained from the manufacturers Matling Ltd., 28 Caxton Street, London, S.W.1, and Fallings Park, Wolverhampton.



Tool-handling simplified with this new equipment.

Small Injection Machine for Prototype Work

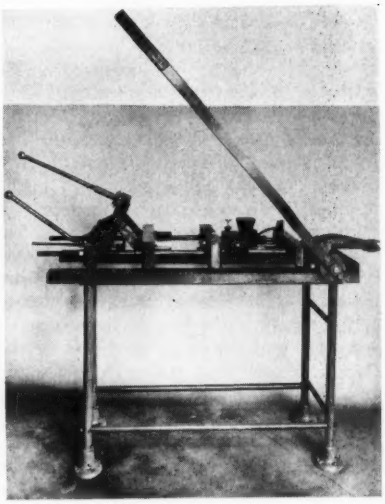
IT frequently happens that injection moulders are asked by customers to make a very short run of a new article. It is uneconomic to use a large automatic machine with a 1-off tool and the cost of a multiple tool would be prohibitive for a short run. Moreover it is frequently found that the tool, as first made, requires modification or that the article was not designed perfectly and has to be modified. This can be very expensive if a multiple tool has been made in the first place.

The object of the Pilot machine is, therefore, to enable the design of the article and of the tool to be checked by making a small run economically. This also permits the customer to test the market for the article by running off a few thousand without having to incur the expense of a multiple tool.

The Pilot bench type hand operated machine has a capacity of half an ounce and is fitted with an efficient thermometer and thermostatic control. The opening provided, in addition to the depth of the tool, is 5¼ in.

The operation is quite simple, after switching on and loading the hopper, the operator works the main lever to fill the cylinder. He then waits until the thermometer has reached the desired working temperatures, closes the tool by means of two conveniently placed levers, one of which works a knee action, giving amplitude of movement, and the other a cam which gives the final movement and great pressure to avoid flash. When the tool has been closed all that is necessary is to throw the main lever, which injects by forcing the ram forward into the cylinder. On opening the cam and knee actions the withdrawal of the tool makes the ejector come into contact with the ejector pin plate and force out the article. While the tool is open the operator replenishes the supply of powder or granules in the hopper.

A great variety of tools can be used with this machine. It is only a matter of minutes to accommodate tools varying in thickness between bolsters from 1 in. to 9 in. No specially designed bolsters are required and prototype tools can be tried out, without even screwing them to the machine, by simply holding them in place by hand while operating the closure. Mouldings up to 5 in. in length and up to 5 in. square have been obtained. Tools from 1-off up to 15-off have been used satisfactorily. The speed of operation is from 1–3 cycles per minute, according to the tool.



Pilot bench-type injection machine.

The price of the machine, ready for screwing to a bench, is £165 ex works. This machine is manufactured by Guardhook Limited of 367a King's Road, London, S.W.10.

Polyester Laminating Resins—Part 2

By J. BRYDSON, A.I.R.I., A.N.C.R.T.,* and C. W. WELCH†

4. Effect of Varying Styrene

It is generally known that a mix containing a high percentage of styrene will cure more rapidly than that with a smaller percentage.

In the following work, however, two questions were investigated:—

(1) What is the effect of reducing the styrene content to zero?

(2) What is the apparent effect on rate of cure if the catalyst system is a constant proportion of the polyester resin only?

The following results were obtained with the following mix:—

Cellobond A.1310 ..	25
M.E.K.P.	1
Cobalt accelerator ..	1
Styrene	X

TABLE 4

Gms. of Styrene per 100 Gms. Polyester	Gel Time (mins.)
0	35
10	35
15	38
25	39
45	38
85	89

In this case the accelerator was cobalt naphthenate in white spirit and not in styrene.

It will be seen that polyester resins cure without any styrene present and in fact with the catalyst based on the polyester resin only, are actually faster.

Styrene, however, is a useful diluent and the fact that it reduces the viscosity and hence improves the wetting to glass means that for hand lay up some such material is necessary.

Gelation of Polyesters in the absence of Naphthenate

In addition to the peroxide-naphthenate initiated cross-linking of polyesters, gelation may occur in five other ways. Two of these, by light and heat, are generally to be avoided whereas a third, that of cross-linking by benzoyl peroxide at elevated temperatures is of commercial importance. In addition an amine-benzoyl peroxide mixture is capable of cold curing.

1. Light Gelation

On exposure to light polyester resins will harden at room temperature. Experience shows that the more unsaturated the resin the greater the rate of gelation.

This reaction is of a photochemical nature, the rate of gelling being proportional to the intensity of light energy incident on the material. The life of a polyester is obviously increased by storage in the dark and to some extent by the use of inhibitors such as quinone and hydroquinone.

There is no record of any investigation of photochemical initiation of polyesters in the absence of oxygen.

2. Thermal Gelation

During the manufacture of polyester resins an inert gas is usually passed through the reaction mixture and vessel. If this is not done there is a tendency to gelation.

This is presumably due to the formation of peroxide or hydroperoxide groupings at or adjacent to the double bonds. These peroxides will then form free radicals capable of initiating polymerization. It is probable that there is a close correspondence here to the hardening of the drying oils.

This gelation is normally reduced by, obviously, the use of inert gas and also by the addition of various quaternary compounds.

3. Gelation by Benzoyl Peroxide at Elevated Temperatures

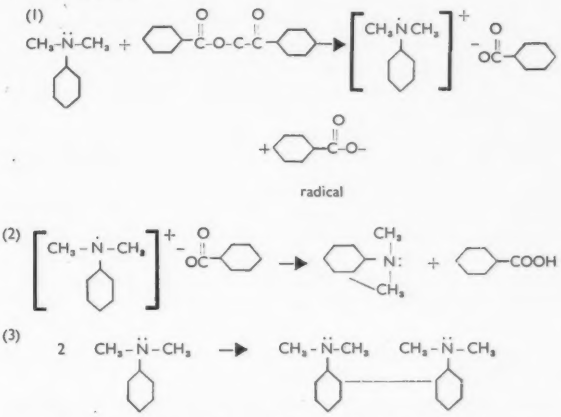
This method is a standard commercial procedure for matched-metal and gunk mouldings. An addition of 2% benzoyl peroxide will cross-link the resin in 1–2 min. at about 100° C.

There is little doubt that in this reaction there is a thermal destabilization of the peroxides to give free radicals. Owing to the somewhat low efficiency of benzoyl peroxide it may well be worth while studying the effect of other peroxides or azo initiators.

4. Gelation by Benzoyl Peroxide and Amines

At one time many room temperature cures were carried out with a benzoyl peroxide-amine system. This method now appears to have gone out of favour due it is understood to inferior properties being obtained with the finished product due to permanent undercure(1).

Horner and Schlenk have proposed a mechanism for this reaction (2) (3).



The first stage of the reaction producing the necessary free radicals for cross-linking.

It seems well worth considering carrying out further work on peroxide-amine systems since it has been indicated(4) that slow curing systems for room temperature work do not fall off in strength at the same rate as the faster systems presumably due to a slower rate of " after cross-linking."

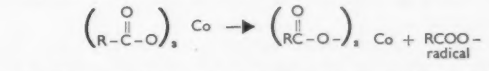
Due to the explosive reaction between amines and peroxides precautions should be taken to see that these two materials do not come into contact with each other except when diluted in the resin.

5. Effect of Cobalt Naphthenate without Peroxides

It has been found that if cobalt naphthenate in solution in styrene is exposed to light, polymerization of styrene may occur. This has caused some difficulty in volumetric measurement of the naphthenate by solidifying in such places as the bores of burettes.

Two possible reactions may occur.

(1) The naphthenate may break down to form free radicals



In this case there is a valency change of the cobalt and the free radical formed may initiate polymerization.

(2) The naphthenate may activate ethylenic peroxides, already present in the styrene, causing polymerization.

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Evaluation of Polyesters

It may seem anomalous that this survey of polyester resins which has so far been more in the realms of applied chemistry should attempt to deal with the physical testing of these resins. The excuse of the writers is that since the value of modifications to formulae, etc., can really only be measured by physical methods then it is necessary to consider the methods that are available. Within the space available, it is only possible to touch upon one aspect, namely that of tests on liquid resins.

As supplied by the manufacturer the resins usually contain a cross-linking agent such as styrene.

Normally the following information is required:—(1) Acid value. (2) Gel time. (3) Viscosity. (4) Styrene content.

Acid value

This test may be carried out in the normal way by dissolving a small sample of resin in acetone or chloroform and titrating with caustic soda. The acid value is expressed as the weight of caustic potash (in mgms.) required to neutralize 1 gm. of resin.

Gel time

The measurement of gel time has been carried out in many ways. Probably the most straightforward method is by the Techne Gel Timer in which a disc moves up and down in the resin until the latter sets. This prevents the motion of the disc which then cuts out the timing device.

In the U.S.A., the S.P.I. method is very general. In this test a tube of resin is placed in an oil or water bath at a stated temperature. The time taken from the moment at which the resin reaches the oil or water bath temperature until gelling occurs is known as the gel time. Other workers also measure the peak exotherm time by means of a temperature recorder or purely by visual observation of gelling.

It is important to distinguish between gelling and setting. The gel time may be considered as the " pot-life " of the catalyzed resin, whereas the setting time is a measure of the time taken for the resin to become hard and capable of removal from moulds, etc. When measuring gel times it is important to standardize on the mass of resin and the shape of the container due to the effect played by bulk and shape factor on the exotherm. It is suggested the Standard Flow Cup of B.S.771 is a useful container.

Viscosity

A variety of methods may be used here but no correlation figures between methods have been published.

A constant shear viscometer of the Ferranti type is suitable. The Techne Water-bath Viscometer is also useful.

Styrene content

The measurement of styrene by the number of double bonds is unsatisfactory due to the presence of the latter in the polyester. A quick and reliable method may be carried out by distilling off the styrene at 150° C. and measuring the weight loss.

Discussion

The authors' investigations have led them to the conclusion that in the field of polyester cross-linking mechanisms alone, we are only on the threshold of a complete understanding of the factors involved. It is possible, however, to gather together the main threads, and to venture an opinion as to the most promising lines of investigation for the future.

If we examine first the naphthenic accelerators, it has been shown that metallic naphthenates other than cobalt offer interesting properties. The most significant point seems to be in the use of two or more naphthenates as a means of acceleration in a manner akin to that of the drying of paints. The analogy of paint or varnish formulations with polyesters is, the authors feel, sufficiently strong to stand until evidence is presented to support a contrary opinion.

It is therefore worth while considering the role of naphthenates in this field in which there appear to be two main points of view concerning their mechanism as driers.

The first view is that, as driers, naphthenates in general, and cobalt in particular, hasten all the stages of drying, namely reduction of initial inhibition, hastening of formation of drying oil peroxides, hastening peroxide breakdown and finally accelerating the cross-linking polymerization. Mueller (5) has suggested that all driers act in the same way but whereas cobalt has a good all-round efficiency, lead and zinc are particularly useful in speeding up peroxide decay. In the experience of the authors with polyester resins, where only peroxide decay is important, the latter part of this statement appears inconsistent with the facts.

A second view is that the drier affects the colloidal complexity of the system (6). It has been considered that cobalt causes rapid coagulation of drying oils whereas lead tends to stabilize. It is felt that this particular approach is more to the point, particularly after examination of the electron micrographs (Fig. 1, 2, 3) showing the degree of dispersion of various ratios of cobalt and lead naphthenate in white spirit.

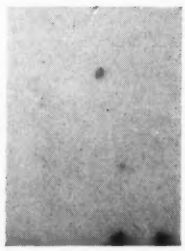

Fig. 1. Co. Naph./ white spirit, 1 : 2. Mag. 12,000x.

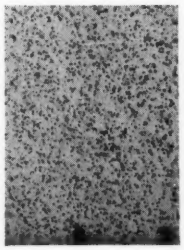

Fig. 2. 75% Co. Naph., 25% Pb. Naph., in white spirit. Mag. 32,000 x.

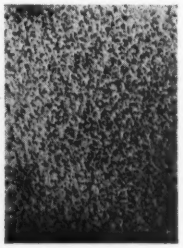

Fig. 3. 50% Co. Naph., 50% Pb. Naph., in white spirit. Mag. 32,000 x.

Subsequent to the publication of the first part of this paper, M. D. Curwen reported in a lecture to the London Section of the Plastics Institute the work of Bowles (7) who offers the view that whereas cobalt naphthenate may be regarded as a pure oxidising catalyst/accelerator, certain other soaps such as calcium and zinc naphthenates function as flocculating agents under specific conditions. This is capable of closer study by means of the electron microscope. From results obtained it would appear that lead naphthenate is a flocculating agent, when used with cobalt naphthenate. This would however still explain the different actions of cobalt and lead naphthenates.

Good dispersion is obviously desirable in any mass where an even degree of cross-linking is to be obtained. The combination of cobalt naphthenate with other naphthenates acting as flocculating agents, may serve to diminish the unfavourable ageing characteristics reported earlier. Another interesting possibility is the use of long chain amines possessing hydrophilic and hydrophobic end groups. A similar colloidal effect may also occur.

Coupled with the foregoing must be the question of practical technology, on a factory scale, in handling polyester resins. It has been stressed elsewhere (*Plastics*, June 1956, 105–107), that due to the sensitive characteristics of both catalysts and accelerators commonly employed, only scrupulous care in weighing and measuring will permit of uniform and even satisfactory results.

Finally, it may be noted with satisfaction that in many fields of application, most notably the commercial vehicle industry, glass reinforced plastics are attracting progressively greater interest. This stimulus may serve to initiate an expanding research programme and bring a closer understanding of the relationship between the chemistry and properties of polyester laminating resins.

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The Properties and Testing of Plastics Materials—Part 8

The Testing of Finished Mouldings

By A. E. LEVER,* A.I.R.I., and J. RHYS,† M.Sc.

THERE is a useful discussion on testing various physical properties using small test pieces, the object being to ascertain whether the properties of moulded materials, usually determined by means of tests on standard test pieces, could also be determined by means of tests on miniature specimens cut from industrial mouldings (1).

The best ways of cutting up the mouldings and the allocation of position for the various test pieces were studied. A summary of results is given in Table 1.

Impact Strength

A description of the Dynstat machine which can be used for static and dynamic tests is given, with a full description of and reasons for the modifications made.

It was concluded that:—

(*a*) The striking distance should bear a constant ratio (1.75) to the thickness of the specimen.

(*b*) Varying the impact velocity affects different materials in different ways. It is probable that the most consistent results can be obtained with high striking velocities. However, for small specimens of weak material, high velocities cannot be used.

(*c*) The shape of the striker is immaterial provided it is not sharp enough to penetrate the specimen.

(*d*) The Dynstat clamp needs modification both to allow small striking distances to be used, and to eliminate local stresses which weaken the specimen.

(*e*) Semi-circular notches as small as 0.12 mm. radius can probably be provided in miniature specimens and are more effective in concentrating the stress during impact.

The effectiveness of the modifications made to the Dynstat machine was noted in a series of tests made to ascertain the variability of results:—

	Perspex	*Ebonite*
Unmodified machine ..	5.4%	39%
Modified machine ..	2.5%	18%

Cross-breaking Strength

Some variations in results were encountered until vibration of the machine was eliminated.

Any shock brought about by uneven application of stress has a marked effect, particularly with thicker specimens.

It was observed that for cold-moulded materials, fracture tended to occur on planes parallel to the neutral plane of bending, therefore, specimens of cold-moulded materials should be as thick as possible.

It was not possible to obtain any relation between individual cross-breaking strength results and specimen size.

Crushing Strength

Baily's formula $Y = y + ny/y^1$ when

y = yield after 10 mins.

y^1 = yield after 1 min.

$n = 0.25$.

$Y = 0.4$ mm. when a 12 mm. specimen is used

can be used to relate the yield at the end of a 10 minute interval to the rate of increase of yield during that interval, to the yield over a long period of time, e.g. 24 hours (6).

It is shown that the strength of the material at the centre of the moulding was about half that near the outside. The need for cutting specimens from appropriate places is emphasized.

The size recommended avoids complications due to non-homogeneity of the specimen.

Electric Strength

The main difficulty in making electric strength measurements on specimens 8 mm. diameter is that flashover occurs in all tests made in air, so that no breakdown of the material can occur.

The technique of using an ebonite shield was found effective, and two adhesives were satisfactory. The best was Rawlplug Durofix and then a 20% solution of polyvinyl acetate in acetone.

Electric strength tests made on miniature specimens should be regarded with more caution than similar tests for other properties.

Surface Resistivity

Special electrodes for miniature testing was found to be necessary, and Aquadag was found to be suitable provided it was thinned down and applied with a pen. Two ordinary "J" pen nibs were soldered together to make a double pen, so that two accurately spaced lines could be applied in one operation.

All measurements were made in a conditioning chamber at 75% R.H.

Plastic Yield

Full understanding of the plastic yield behaviour of a material is only obtained when the effects of both time and temperature on the yield are investigated. The stress must be of known constant value.

To a specimen in the form of a bar a bending stress is applied. The bar can be loaded as a cantilever or subjected to a three-point or four-point loading. There is little to choose but the more uniform stress distribution is obtained with a four-point loading.

The Marten's test makes use of a four-point loaded beam and the specimen is heated at a uniform rate of 50° C. per hour, and the plastic yield temperature is taken as that temperature at which a specified deformation occurs (7).

This test has a certain popularity because results can be obtained from a single specimen in a short time, but it gives no indication of the way in which yield increases if a material is kept under prolonged stress at its plastic yield temperature.

Two other defects are:—

(*a*) The results are not reproducible unless

TABLE I. SUMMARY OF RESULTS

Property Tested	Apparatus	Size of Test Piece	Remarks
Impact strength ...	Dynstat mod. pendulum	10 × 10 × 2 mm.	Striking distance should be 1.75 times specimen thickness
Cross-breaking strength	Dynstat—unmodified	15 × 10 × 4 mm. to 10 × 5 × 1.6 mm.	Variability large. Take number of tests
Crushing strength ...	Beam type. M/c load to 45 Kg. Ratio 22.2 to 1.0	3 mm. cube or cylinder	
Heat resistance ...	Glow-bar	10 × 15 × 1 mm.	Classified into clearly defined groups
Plastic yield ...	Three-point load Vicat needle	5 × 10 × 1.5 mm. or 10 × 10 × 1 mm. Disc 8 mm. dia. 1 mm. thick	Short time-temp. inc. 50° C./hr. Long time-stress applied at const. temp.
Specific gravity ...	Weigh air and liquid	Immaterial	
Water absorption ...	Immersion const. humid. vessels	2 cm. × 1 cm. × 0.15 mm. or pdr. filed from moulding	Immersion (strip). Exposure to known R.H. for pdr.
Electric strength ...	Electrodes 2½ mm. Ebonite flash-over shield	Discs 8 mm. dia. to 1 mm. thick	Tests under oil
Surface resistivity ...	"Aquadag" line electrodes marked with pen. Metal contact fingers	Surface actual moulding	Varies with gap between electrodes

*Consultant. †F. W. Berk and Co. Ltd.

the rate of temperature rise is kept absolutely constant.

(*b*) When the temperature is rising there is a temperature gradient through the specimen (depending on the thermal conductivity of the material) so that the plastic yield temperature may appear too high.

In British specifications the long time test is applied as a proof test to indicate whether a material has a yield greater or less than a certain specified amount at a given temperature. This is convenient but gives no fundamental information about the properties of the material.

The Vicat Needle test does not apply the stress by bending but a loaded needle is applied to the surface of a specimen, and the degree of penetration is taken as a measure of plastic yield. Details are given of a modified and unmodified form.

Plastic yield tests on miniature specimens may be affected by stresses occurring in the specimens as a result of moulding and machining which, on heating, could cause a deflection to be added to, or subtracted from, the plastic yield.

It is assumed that materials undergo a thermal reversible charge, but this is not always the case. Misleading results may occur by increasing the cure of the material.

In the majority of cases some form of pre-heating was found to be necessary. Specimens were not buckled and settled on the supports, particularly on long time tests; 15 minutes pre-heating was adopted.

Three-point loading apparatus was also used, and it was shown that this apparatus can furnish approximate value of plastic yield temperatures in short time tests, and can be used for long time tests which will give values agreeing with those obtained from standard specimens to within 1° C.

Resistance to Heat

The manner in which insulating materials are affected by heat varies according to the way in which the heat is applied, e.g. arc, flame, radiant heat, rise in ambient temperature and contact with hot bodies.

The essential difference between the German glow-bar method and the British lies in the fact that the former determines the degree of damage at a definite temperature of 950° C., while the latter determines it at the first temperature (accurate to 50° C.) at which the specimen ignites within one minute.

Specific Gravity

Cotton thread should not be used to suspend the specimen for weighing in water as a certain amount of water may be absorbed by the thread above the liquid surface, so that the weight of the specimen in water appears too great.

Water Absorption

It is recommended that the specimen be machined to remove the moulding skin before tests are made.

In using the powder method, it should be noted that the structure of the original moulding has been lost, and with it, the features which are mainly effective in preventing penetration of moisture.

The physical evaluation of small samples of plastics is covered in (2) and the following are some brief notes:—

(*a*) For impact strength the Izod machine is not recommended but the Charpy type test on notched specimens.

(*b*) Softening point by dilatometric determination of the apparent second-order transition temperature (T_m).

(*c*) For flow, the Atkinsin-Nancarrow plastometer is used.

(*d*) Brittle temperature was made by refractometric determination of T_m on thin films of plasticized material using an Abbe refractometer with cooled prisms.

(*e*) Resilience was determined with a Dunlop Tripsometer type machine.

Test methods for p.v.c. insulating and sheathing compounds cut from finished cables are given (3). There is a useful table giving minimum physical, electrical and other properties for various grades.

A method is described (4) for a non-destructive determination of inorganic pigments, fillers and reinforcing fibre content of plastic materials, particularly polyesters, where the insolubility of the resin makes difficult the use of destructive methods.

Measurements are made on a Ansco-Sweat Densiometer. The main difficulty would seem to be the initial preparation of comparative standards.

A non-destructive test (5) for plastics using X-ray technique is described.

U.L. Impact test for plugs consists in exposing the plugs for 24 hours at 392° F., then dropping them on 39-inch cords through a 90° arc against a maple block (8).

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A German High Frequency Welding Machine

A short account of a newly designed welder

By V. BIRD

IN manufacturing items of plastic sheeting and film, the strength of the bond is highly important. The best way to carry out bonding is by means of the fusion of opposing surfaces, which produces a strong homogenous seal. This is attained by welding.

Electric welding methods of plastics differ basically from the processes employed in the electric welding of metals, which possess excellent thermal conductivity, while plastics are known to be more or less poor conductors of heat. This is especially true of thermo-plastics. Direct heating by passing a current between the two sheets to be welded as in resistance welding, or by means of an electric arc struck between an electrode and the sheet as in arc welding, is not possible.

Although direct application of heat to the material to be welded through the use of a heated platen or die constitutes the simplest method, there are certain difficulties inherent in this, insofar as synthetic resins not only have low thermal conductivity but are also highly sensitive to heat. Most of them decompose at a temperature only a few degrees above the fusion point. Since, when heat is applied through transfer, a certain temperature drop from the heated surface towards the inside of the material has to be taken into account and since the use of excess heat to make up for this drop is not feasible, the method of bonding thermoplastic sheeting by direct application of heat through heated platens is restricted to thin films.

To prevent thin thermoplastic film from adhering to heated platens and seams from being damaged, both heating and cooling of the areas of seam have to be effected while uniform pressure is applied. Heat-impulse welding answers these requirements in an ideal way. Although the method of heating employed is standard, using heated metal surfaces directly in contact with the films, the construction of the impulse-heated platens enabling both heating and cooling under constant pressure is very special.

High-frequency welding is done in a manually or foot-operated press. The platen which carries the electrode shaped according to the profile desired in the bond produces the pressure needed to cause fusion to opposing surfaces. Pressure is applied for a period long enough to allow both bonding and cooling. The high-frequency energy required to effect welding is produced by a thermionic oscillator.

If welders exceed a certain capacity, generators and presses are preferably built in separate units. Although this arrangement requires the use of additional control gear, this slight expense is completely outweighed by outstanding advantages by operation of two or more presses from a single generator. As cycles are so timed that the full generator output is applied at each working stroke of the presses, the operating economy of high-frequency welding is considerably improved.

A. Schwalbach KG., Hamburg, and Herfurth GmbH., Hamburg-Altona, manufacture the high-frequency generator "Trumpf" 1000S, 1000 Watt, with a specified frequency of 27,12 megacycles. High-frequency generators with unstable frequency, working in the range of 40 and 45 megacycles are also made by the same firms.

If operation within the permissible variation of frequency is not possible, or if generators have to be operated at frequencies beyond the range set aside for industrial use, both generator and press require complete shielding. To make oscillators operating at any frequency non-interfering, Herfurth GmbH, supplies 20-sq. ft. framed screens easily assembled to cubicles of various sizes to suit requirements.

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Special Cellulose-Filled Urea Moulding Powder of High Translucency. For high quality button production.

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Plasticised Scarab
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Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 0d. each (including postage).

B.P. 753,729. Container particularly suitable for storing transparencies. To: Agfa A.G. fur Photofabrikation.

For storing photographs, negatives, index cards, micrographic slides in a box to be slid into a supporting case. Plastic sheets are suitable for making all parts, in particular the box.

B.P. 753,752. Floor tile compositions from petroleum resins. J. F. McKay, Jr., A. H. Gleason. To: Esso Research and Engineering Co.

B.P. 753,784. Plasticizers for thermoplastic materials. To: Badische Anilin- and Soda-Fabrik A.G. (Germany).

Esters of para-chlor-gamma-phenylbutyric acid, in particular for halogen-containing thermoplastic materials.

B.P. 753,796. Closure devices for orifices. To: Press Plugs Pty. Ltd. (Australia).

Resilient plugs for sinks, baths, etc., but also as closures for petrol tanks where the plug may be combined with a plastic cover.

B.P. 753,815. Process for the production of plastic foil. To: Deutsche Gold- und Silber-Scheideanstalt vormals Roessler. (Germany).

The plasticizer used in the production of cellulose base foil contains an oxide aerogel of a particle size of 0.05 micron or less (e.g. colloidal silica).

B.P. 753,840. Device for dispensing definite quantities of liquid from a container. To: Persil-Fabrikken (Norway).

A cup and tube with bowl shaped collar made from transparent material.

B.P. 753,852. Respiratory masks. H. G. Bloomfield. To: Martindale Electric Co. Ltd.

With a special eye shield.

B.P. 753,862. Toothbrush with a flexible head. L. R. Bressler.

A sectional brush with sections moulded in spaced relationship on a flat flexible member made of nylon.

B.P. 753,896. Tubes of polyvinyl chloride. To: Dynamit A.G. vormals Alfred Nobel & Co. (Germany).

A metallic layer (wire, strip) is incorporated in or on the surface of a hard polyvinyl chloride tube for the transport of grain or flour to remove static electricity by an earthing connection.

B.P. 753,906. Plastic brassieres. S. W. Deane (South Africa).

Moulded in one piece from homogeneous soft plastic.

B.P. 753,923. Spectacles. H. C. Binder.

For rimless appearance at the tops of the lenses.

B.P. 754,034. Films for packaging. To: Goodyear Tire & Rubber Co. (U.S.A.).

Of unstretched rubber hydrochloride for bagging dried fruit, wrapping cigarette packs, etc.

B.P. 754,047. Doll's eyes. L. Jesman. To: J. F. J. Products Ltd.

A part-spherical eyeball portion includes an iris and a separate eyelid portion with a swivel connection.

B.P. 754,052. Stretchers. R. L. Dunn, B. Ellison. To: Dunlop Rubber Co., Ltd.

The mattress, e.g. of expanded polyvinyl chloride, may be supported on a pan of a reinforced synthetic resin composition.

B.P. 754,090. Drum closure. To: Ricke Metal Products Corp. (U.S.A.).

With a replaceable bung ring of polyethylene.

B.P. 754,146. Packaging of biscuits and the like. H. Hudson. To: Frears Ltd.

A transparent or translucent heat sealable material (viscose foil; cellulose film) is used and a metal foil tear strip is incorporated which adheres to, or fuses together with, the wrapping material when subjected to heat.

B.P. 754,161. Containers for lighter flints. H. Lowenthal.

With a series of annularly disposed compartments in a circular body under a transparent rotatable cover, cast from a synthetic resin.

B.P. 754,215. Armoured synthetic plastic tubes, vessels, pipe fittings and the like and method of producing the same. To: Dynamit A.G. vormals Alfred Nobel & Co. (Germany).

Tangential and axial initial pressure stresses are produced in the synthetic plastic tube (hard polyvinyl chloride) by deformation of the tube and of the surrounding metal armour so that even at the lowest operating temperature and/or with internal positive pressure there is still a residual initial pressure stress in these two axial directions.

B.P. 754,219. Process of improving finished corrugated hoses of synthetic resins. H. Vohrer (Germany).

The complete hose (with internal wire helix) while still on the mandrel, or after removal therefrom, is subjected to a temperature of 80–100° C. This removes the detrimental tension at the crest of the corrugations and improves flexibility and resistance to outer damage.

B.P. 754,221. Buckles for securing the ends of sanitary napkins to a sanitary belt. To: Kimberly-Clark Corp. (U.S.A.).

Made of nylon and moulded in one piece.

B.P. 754,254. Catapults. J. H. T. Harrington.

A handle with two elastic arms formed integrally with each other (by moulding, injection moulding, die casting).

B.P. 754,282. Device more particularly for making out hems. M. Meissner-Bub. (Switzerland).

B.P. 754,296. Face screen. To: Focus Veilig N.V. (Netherlands).

Refers to the securing means for the window in a welder's screen, which consist of a groove and two flexible U-shaped strips.

B.P. 754,300. Toy aeroplane. M. G. Dixon.

B.P. 754,312. Crates for bottles. E. K. Cole Ltd., W. G. Savory.

A wooden crate with base and fingers moulded of polythene.

B.P. 754,316. Ice freezing trays. To: General Electric Co. (U.S.A.).

With undulated inserts (zigzag or other wave form) and a lever to apply a lifting or stretching force.

B.P. 754,323. Ice trays. To: Robert Bosch G.m.b.H. (Germany).

With flexible grid-like insert of polyethylene.

B.P. 754,326. Machine for moulding heads made of thermoplastic material upon tubular containers. To: Uni-Tubo S.A. (Switzerland).

For the manufacture of flexible tubular containers of polyethylene. The machine comprises an injection head and a plurality of moulds arranged in an indexing device. Each mould is formed of a punch supporting a tubular container and an axially movable die keeping the mould closed during indexing.

B.P. 754,374. Die casting and injection moulding machines. S. Smith. To: E.M.B. Co., Ltd.

The position of the hydraulic control piston at which the change from slow (initial stroke) to rapid movement occurs, can be varied and also the rate of slow motion.

B.P. 754,449. Paper and like bags formed with closure flaps. J. W. Randell. To: John Dickinson & Co., Ltd.

Opposite walls are formed e.g. from two dissimilar materials (opaque paper, transparent cellulose sheet); no cutting out or removing material from web.

B.P. 754,492. Couplings for garden hoses, flexible electrical conduits and the like. J. W. Kelly. To: Moulded Products (Australasia) Ltd.

Particularly suitable for flexible tubing of synthetic plastics. The fitting, a double conical insert and a loose collar to be screwed over the tube end, may also be of plastic material.

B.P. 754,502. Framed products based on polyurethanes. To: Farbenfabriken Bayer A.G. (Germany).

B.P. 754,513. Production of expansible thermoplastics. To: Badische Anilin- & Soda-Fabrik A.G. (Germany).

Caking of particles of expansible styrene polymers when treated with liquid raising agents can be eliminated by treatment in a closed vessel at elevated temperatures with mixtures of water (major amounts) and volatile aliphatic or cycloaliphatic hydrocarbons (minor amounts).

B.P. 754,521. Method of making cellular plastic articles from vinyl aromatic resins. L. C. Rubens. To: Dow Chemical Co.

B.P. 754,522. Latent foaming compositions of vinyl aromatic resins and method of making cellular plastic articles therefrom. C. L. Rubens. To: Dow Chemical Co.

B.P. 754,526. Method and apparatus for the manufacture of tubes from thermoplastic material. To: A. Tudor (Sweden).

Polyvinyl chloride tubes are made on a stationary mandrel along which one or more perforated pre-formed tapes of the plastic material are fed continuously. The edges of the tapes are joined together. The tube is provided with an interior coating or sleeve of fibrous material (glass fibres). The composite tubes may be used in electric accumulators (tube plates).

B.P. 754,534. Knitting tension and needle gauge. P. Eaton, C. J. Taylor.

B.P. 574,582. Pouring devices for bottles. To: Schenley Industries Inc. (U.S.A.).

With a flange having a low adhesive force on liquids made, e.g., of polyethylene.

B.P. 754,624. Polymeric resins containing phosphorus. To: Albright & Wilson Ltd. (U.S.A.).

For forming corrosion-inhibiting films on metallic surfaces.

B.P. 754,637. Bag or case with heat insulation. To: Peter Johs. Petersen A.S. (Norway).

The outer bag body is preferably made from a material having good heat and light

reflecting properties such as a sheet of synthetic resin material containing powdered aluminium.

B.P. 754,722. Shock-resistant plate compositions. W. N. Stoops, B. A. Price. To: Union Carbide & Carbon Corp. (U.S.A.).

A copolymer resin of butadiene and styrene.

B.P. 754,764. Holder for pads of cleaning, polishing and scouring material. J. Clavel (France).

A one-piece handle (upper part) and pad holder (lower part) with two sets of teeth around the bottom edge of the lower part.

B.P. 754,777. Collapsible or folding ladder or support. T. O. Miller.

Made of a number of H-sections drawn together by cords running through the hollow side tubes. Plastics is mentioned as possible material.

B.P. 754,831. Stretching and laminating thermo-stretchable film. To: Wingfoot Corp. (U.S.A.).

The laminate is made of a thermostretched film (rubber hydrochloride, polyethylene, vinyl films), an adhesive (microcrystalline wax of petroleum origin) and an unstretched sheet material (metal foil, paper, board). The thermo-stretchable film is simultaneously heated and stretched and laminated to the sheet material.

B.P. 754,863. Boxes for display purposes. To: William Paton Ltd.

Pilfering made difficult as lid must be raised towards customers.

B.P. 754,879. Inflated globe map. M. Blaine.

Polyvinyl chloride as preferred material.

B.P. 754,936. Seam-welding of thermoplastic synthetic sheet materials. To: G. M. Pfaff A.G. (Germany).

Refers to the formation of a seam by a sewing machine and the heating to welding temperature by electric heating bands arranged on stationary carriers in front of each of the two pressure providing feed rollers. The ends of the bands project beyond the carriers and slide resiliently on the material drawn into the nip between the rollers.

B.P. 754,952. Manufacture of cellular compositions. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

A vinyl chloride polymer is mixed with a blowing agent (giving off nitrogen on decomposition), a plasticizer, fillers, stabilizers, pigments. The mixture is heated to 60° to 130° C. for foaming, then to 130° to 200° C. for strengthening and toughening the foam.

B.P. 755,035. Extrusion of plastic materials. To: Celanese Corp. of America (U.S.A.).

A thermoplastic composition is extruded in a temporarily heat-fluidized condition through a passage with a die at the end. Another thermoplastic composition is injected into the stream of the first composition, also in heat-fluidized condition, at points distributed across the width of the passage. If the first material is, e.g., a transparent clear water white material (cellulose acetate) and the second a dark-coloured material (cellulose acetate containing brown pigment), an interesting ornamental effect is produced in the extruded sheet.

B.P. 755,177. Process and apparatus for the manufacture of seamless bottle-shaped hollow bodies, particularly from thermoplastic or phenoplastic material. To: Chemica A.G. (Germany).

A hollow shaft is displaceably mounted in the mould as part of the mould. After injection of the material an expanding medium is introduced while the shaft is shifted into a second position so that the form of the finished bottle is obtained by blowing the moulded piece up against the outer walls.

B.P. 755,221. Method and means for flanging an end of a thermo-plastic synthetic resin pipe. F. J. Folkard. To: J. S. G. Folkard Ltd.

Refers to a polythene pipe. The pipe end is supported on a rigid core. The tool assembly includes an internally tapered collar and a collet for wedging the pipe within the collar and an annular former part operating with axial pressure. The tool is provided with a heating attachment.

B.P. 755,224. Containers for liquid adhesives. C. S. Garland.

Use of a (plastic) cap with an absorbent pad, which can be fitted to existing bottles.

B.P. 755,295. Hypodermic ampoules for direct injections. M. Berthiot (France).

The two-part ampoule is made of flexible plastic material with a constriction between a closed tubular portion and an open tubular portion. The needle is set in a needle carrier in the open portion and protected (for transport) by a cap. Polyethylene is used throughout.

B.P. 755,309. Wigged head for a doll or the like. American Character Doll Co. Inc.

A standardized wig body is formed (e.g. of vinyl resins) and the dolls' heads of this size are provided with a recessed portion for the wig body so that wig bodies and heads may be manufactured without regard to hair styles. The hair tufts may then vary to form widely different wigs.

B.P. 755,327. Manufacture of leather or fabric covered buckles, buttons and like articles. M. Shenderey.

A covering material of an inner layer of polyvinyl chloride and an outer layer of leather or fabric. The plastic edges of the cover are welded around the metal core.

B.P. 755,332. Device for threading wires through hems of curtains or the like. F. H. Shirley.

B.P. 755,448. Dental material. To: Farbenfabriken Bayer A.G. (Germany).

B.P. 755,449. Combined container and mixing pen or tray, for example, for artists' colours. J. P. Gowland (U.S.A.).

A one-piece moulding (or extruded piece) with hollow deformable paint containers from which paint may be squeezed into depressions in the tray after puncturing the containers.

B.P. 755,460. Containers for medicine. N. H. Pickering.

A plastic ("Ambythene") container with measuring graduations on the inside surface of a transparent part. The air-tight fitting lid has measuring compartments.

B.P. 755,475. Machine for the production of moulded articles. J. A. Petersen.

Refers to the arrangement of a rotatable frame with radially projecting mould elements and plungers. Within the rotatable frame is a stationary frame with a plate for receiving moulded articles, e.g. gramophone records.

B.P. 755,482. Method for the manufacture of brushware having a metal holder, in which the fibre tufts consist of thermoplastic, material, and brushware manufactured by said method. J. R. Zeilstra.

B.P. 755,540. Artificial plants and the like. A. E. Hendy, W. A. Weller.

For use in aquaria. The fronds (upstanding parts of the plants) are made from thin plastic sheeting having a specific gravity lower than water (dyed polyethylene sheeting 0.002 to 0.004 in. thick).

B.P. 755,613. Apparatus for continuously measuring the melt viscosity of thermoplastic materials. F. Jackson. To: Imperial Chemical Industries Ltd.

B.P. 755,710. Decorative electric lamp fittings. R. F. Branch.

In the form of stars utilizing the property of certain plastics to transmit light from the bulb of a lamp through the star body towards the peripheral edges of the star.

B.P. 755,714. Modular light panel. H. K. Wong. To: Cepco Inc.

A pair of diaphragms of (preferably) vinyl plastics are secured together at their peripheries. One or both of the diaphragms are embossed and light diffusing forming between them a plurality of closed cells. The panels may form a luminous ceiling of high intensity illumination with relatively low source brightness.

B.P. 755,738. Surface treatment of polyethylene-containing structures. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

In order to promote the adhesion of e.g., printing inks and other materials, the film is subjected as it is extruded at a temperature between 150° C. and 325° C. into a bath, to the action of a certain agent selected, e.g. from aqueous solutions of the halogens, mixtures such as nitric and sulfuric acids, in the presence of ultraviolet light (preferably in the quench bath at temperatures between 25° and 65° C.).

B.P. 755,815. Closure caps. J. E. S. Lockwood.

A two-part closure for dispensing the contents without removing the cap.

B.P. 755,879. Cosmetic stick container. A. M. A. de Guridi, D. Guridi.

For eyebrow sticks. The stick may be pushed well outside the container for sharpening.

B.P. 755,940. Louvre assemblies and the like. A. R. Pickess, New Era Industries (Tottenham), Ltd.

Assemblies of intersecting panels for louvres of lighting systems with slots arranged at a short distance from the edge ending in a slit towards the edge of the strip so as first resiliently to engage the associated strip, then ensuring a positive interlock.

B.P. 756,045. Tubular extruded products of thermoplastic film-forming material. E. E. Stimson, J. P. H. King. To: British Celanese, Ltd.

A plurality of parallel tubes integral with one another are extruded (by screw extruder) through a die divided by forwardly extending cores into a system of narrow annular parallel passages. A cross section of a honeycomb of hexagonal cells in three rows is recommended.

B.P. 756,053. Dispensing package for liquids. C. L. Zabriskil.

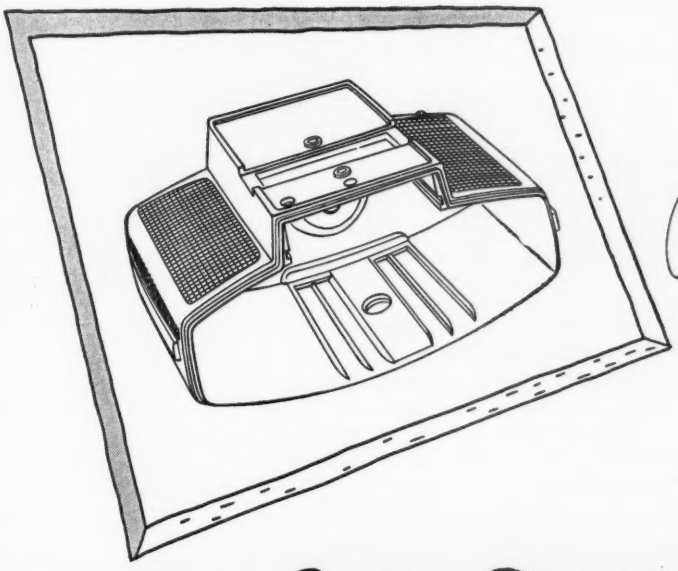
Flexible polyvinyl alcohol bags for holding fire extinguishing liquid (carbon tetrachloride). The liquid is discharged by manual pressure on the bag through a nozzle hermetically sealed by a removable closure device.

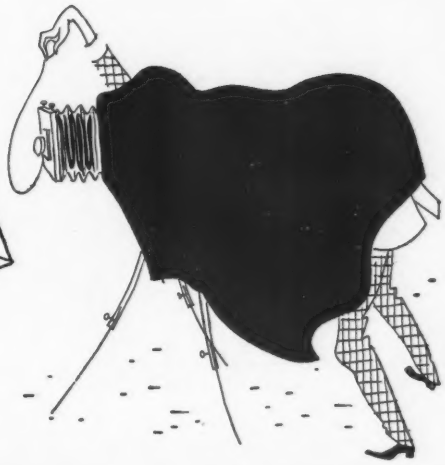
B.P. 756,061. Handles for domestic utensils. D. Archer. To: Hotpoint Electric Appliance Co., Ltd.

A one-piece plastic hand grip with two metal attachment portions joined by a bridge portion which is received in a groove underneath the hand grip.

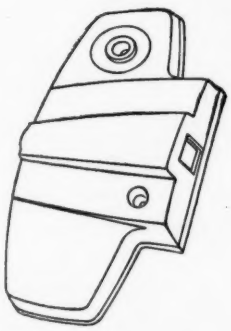
B.P. 756,076. Process of bonding materials with isocyanate modified polyester. To: Farbenfabriken Bayer A.G. (Germany).

For bonding metals. The amount of diisocyanate, used to modify the polyester, is in excess of that capable of reacting with the end groups of the polyester. No cross-linking agent is employed.





Putting Plastics in the Picture!



When Kodak designed their new camera the "Cresta" they naturally wanted the best people to mould it for them. That's when EKCO PLASTICS stepped into the picture. Our experts, with their extensive knowledge and vast experience were asked to assist in the moulding. The help we were able to offer in the way of high quality, large scale output enabled this famous Company to market another of their successful cameras most economically. Ekco Plastics may well have the answer to *your* production problem. Our designing, tooling and moulding experts are at your service.

Kodak Camera Moulding

The casing and other parts were moulded in black phenolic material which produced a hard wearing, smooth surface finish. Essential design features of the camera body demanded a split tool, and a 60-ton single side-ram press is used giving 18 lifts per hour (36 mouldings). Top is moulded in a 6-impression tool on a 175-ton press giving 15 lifts per hour (95 mouldings). A 9-impression tool is used for the lens mount with a 30-ton press: output 135 mouldings per hour. The spool holder is injection moulded in black polystrene. A 2-impression tool is used on a 4-oz. injection machine giving 92 mouldings per hour.

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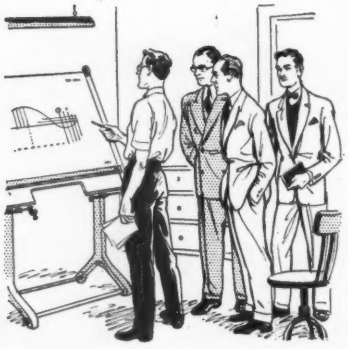

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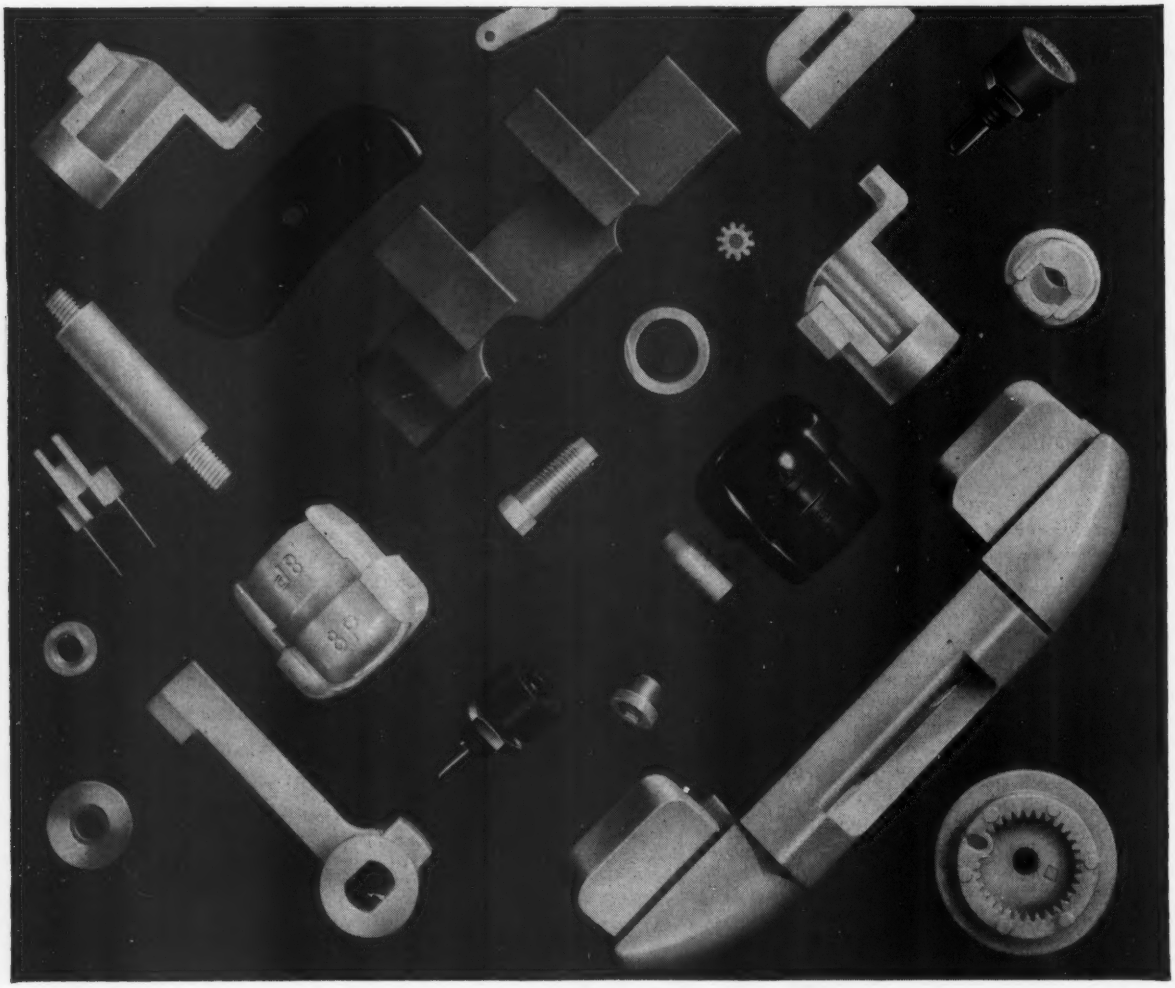

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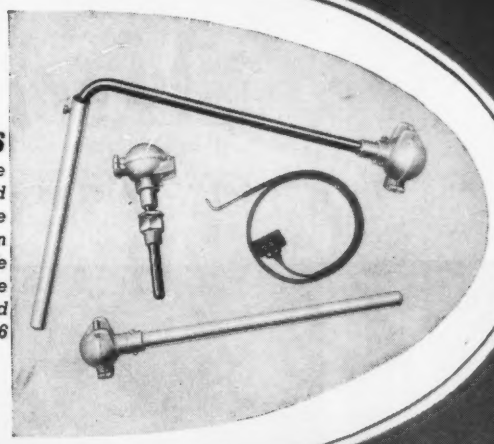

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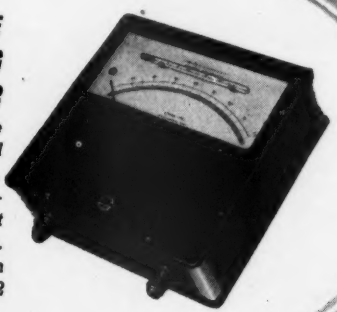

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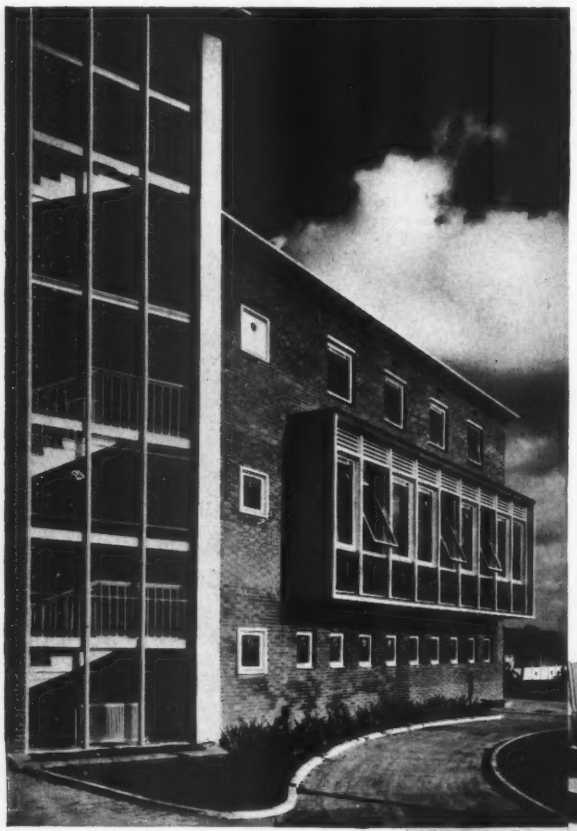

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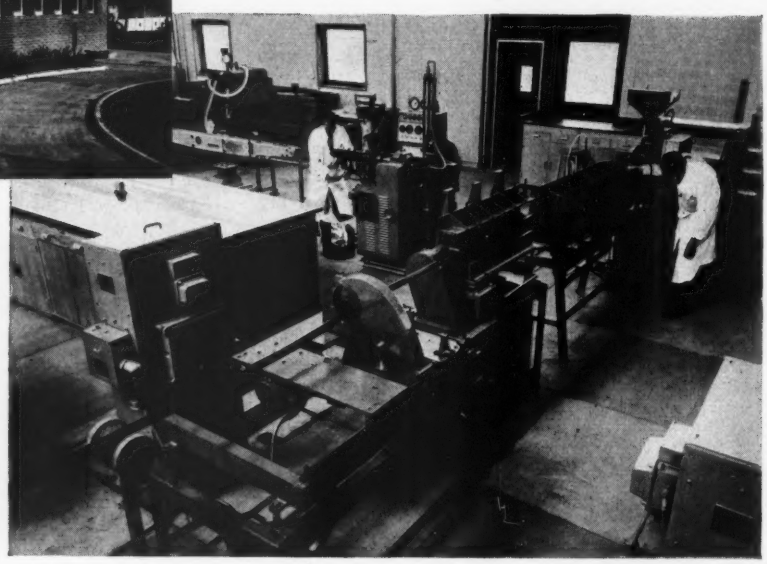

ABOVE. This photograph shows a corner of the administrative wing of the new Research Laboratories at I.C.I. Plastics Division.

RIGHT. An extruder in a section of the semi-technical area of the new Technical Service & Development Laboratories of I.C.I. Plastics Division. This building with its equipment cost £500,000.

'Maranyl' is the registered trade mark for the nylon compounds manufactured by I.C.I.

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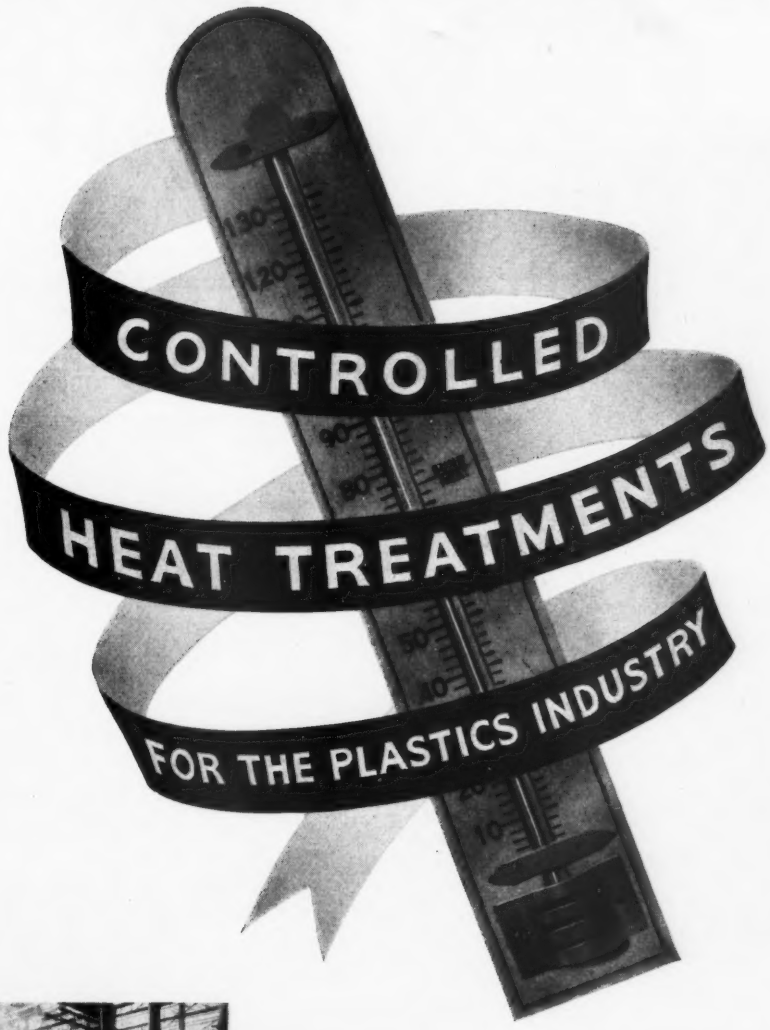
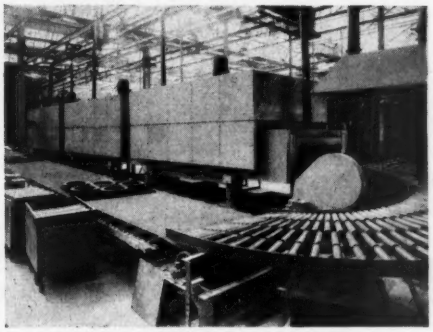
SPOONER





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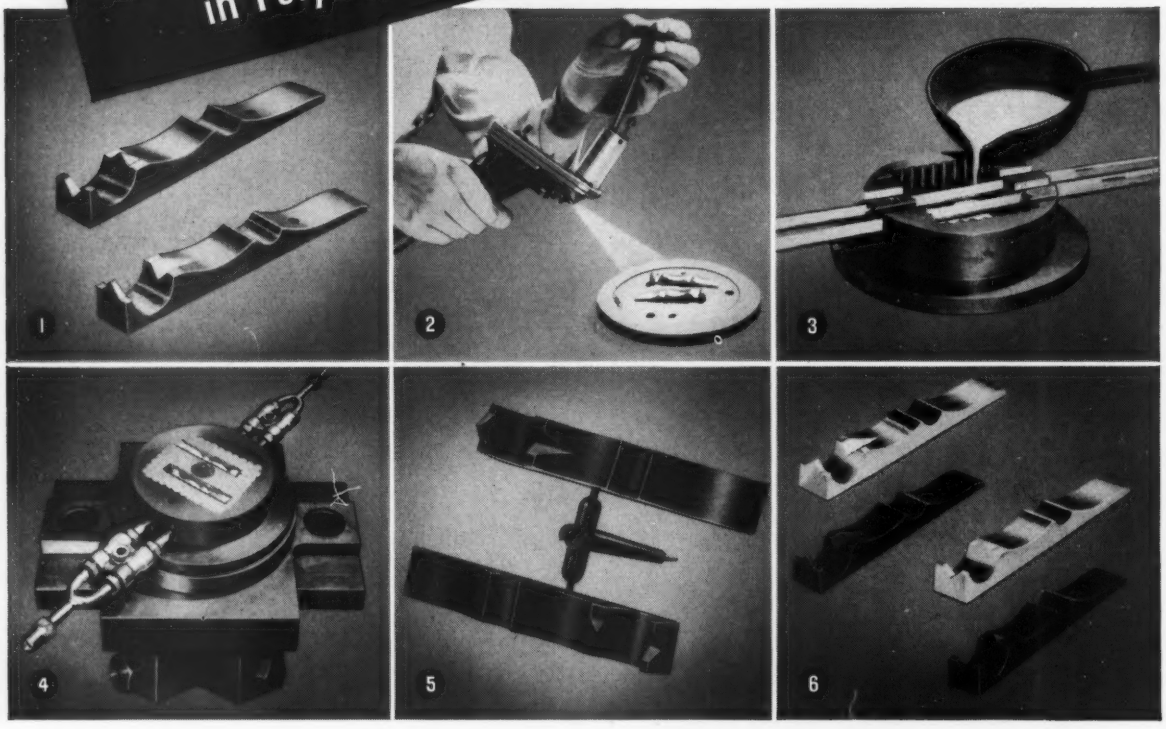
By courtesy of Messrs. S. Smith & Sons (England) Limited, we illustrate manufacture of injection mould for production in Polystyrene in a total time of 33 hours and a fraction of cost of machining.



1. Aluminium master pattern.
2. Spraying pattern with Cerrocast.
3. Pouring molten Cerrocast to back sprayed shell and embed water cooling tubes.
4. Complete mould. 5. Typical shot.
6. Comparison of patterns and mouldings.

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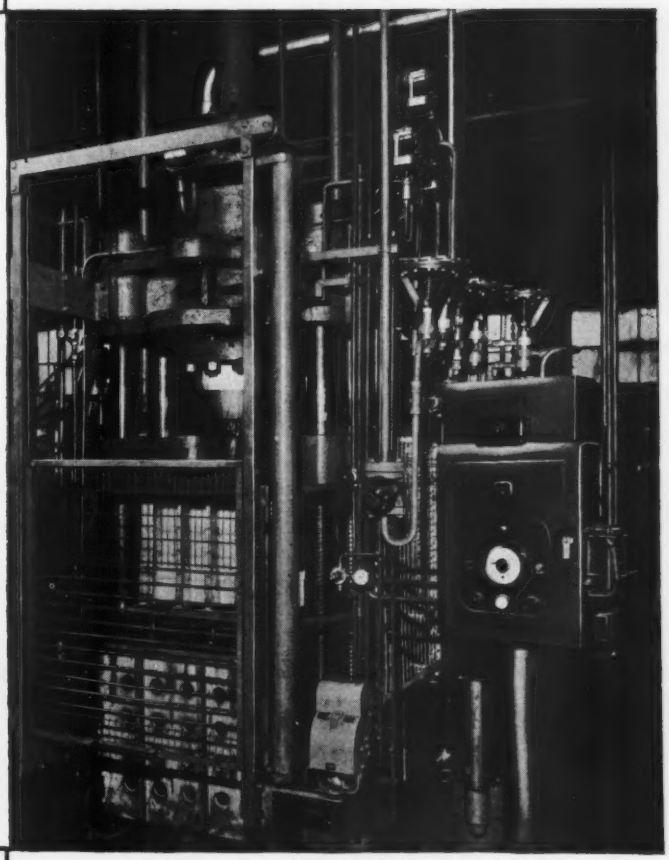

Bristol's Model CDX 500 Cycle Controller

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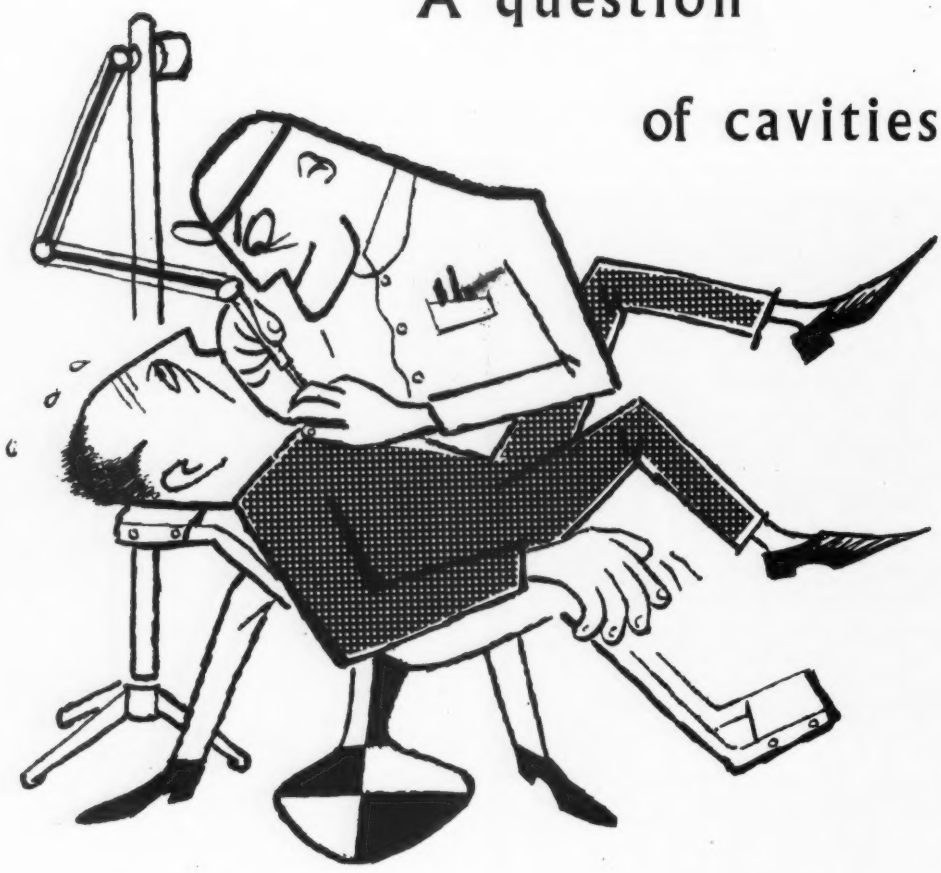
A question of cavities



. . . but not the hard way. If you let us make them for you (or make the complete tool for that matter) there will be no need to get upset about the detail involved. Electroforming takes care of all that—you get a die equivalent in accuracy to the master. What is more—the cavities may cost you from 20% to 80% *less* than by other methods! If you are concerned with injection moulding, blow moulding or slush casting then you must be interested in electroformed dies. Why not write for literature?

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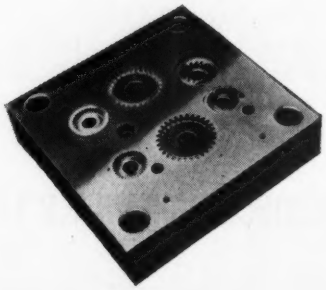

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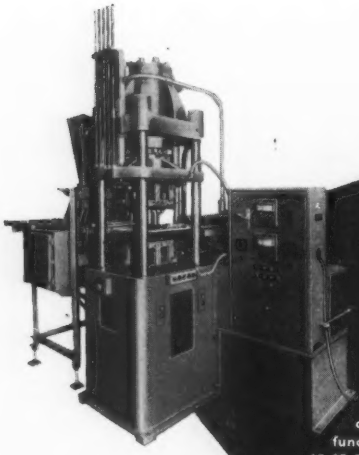

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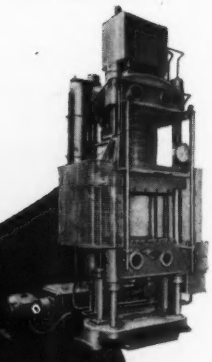

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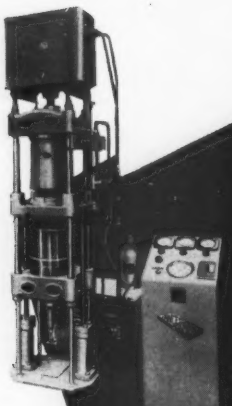

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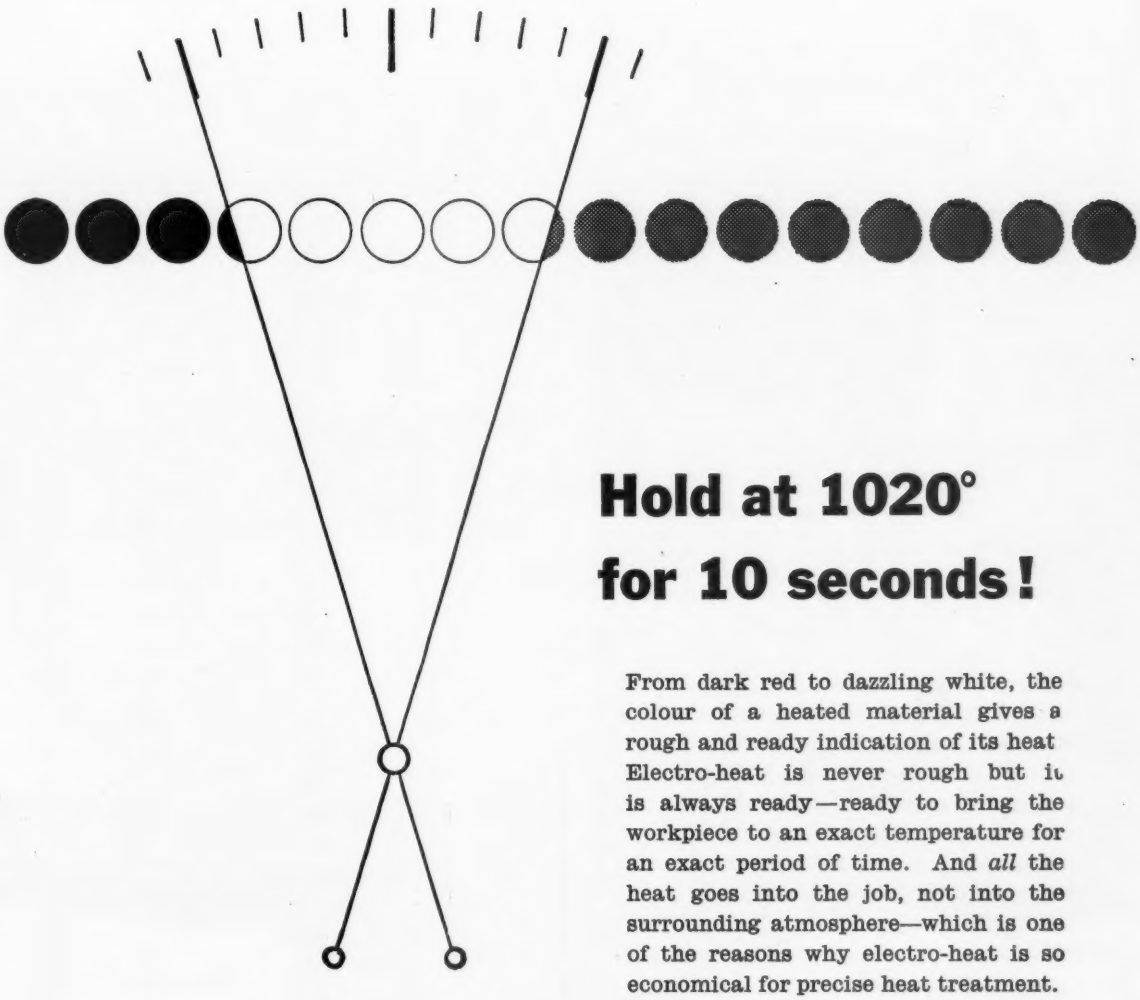

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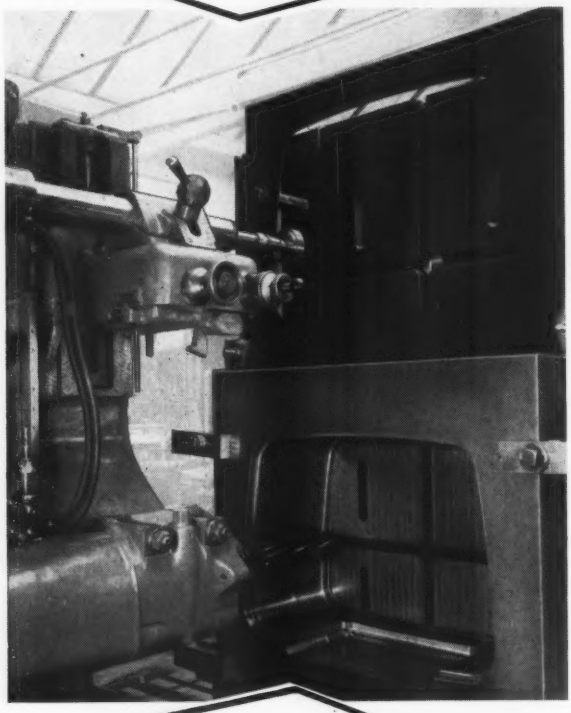

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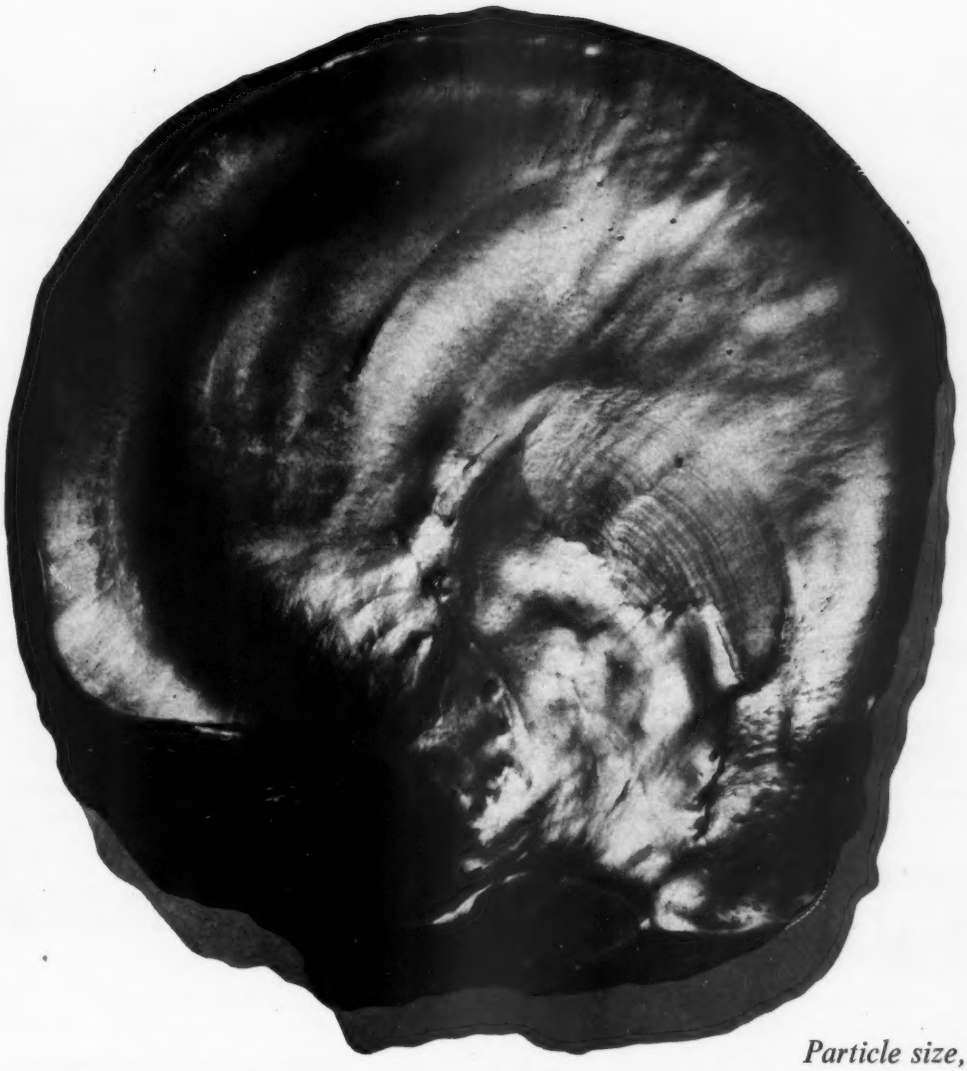

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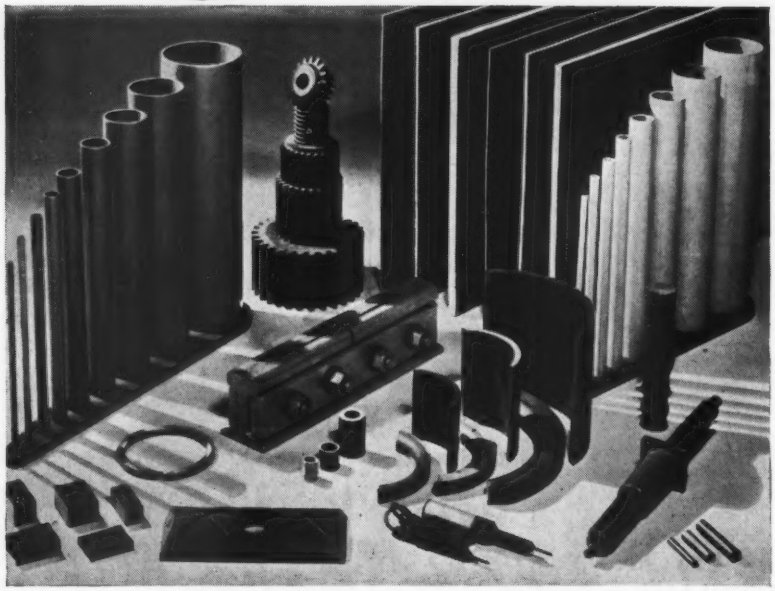

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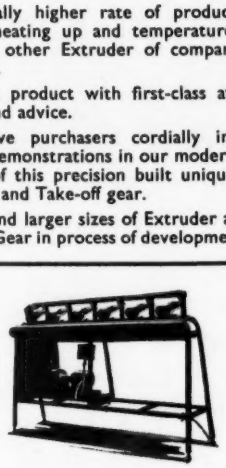

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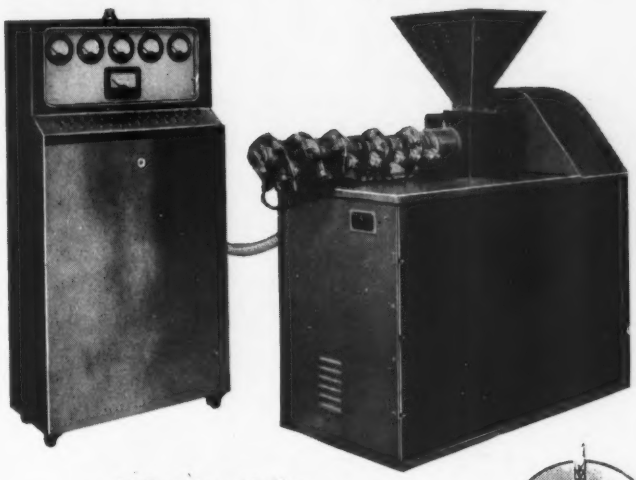

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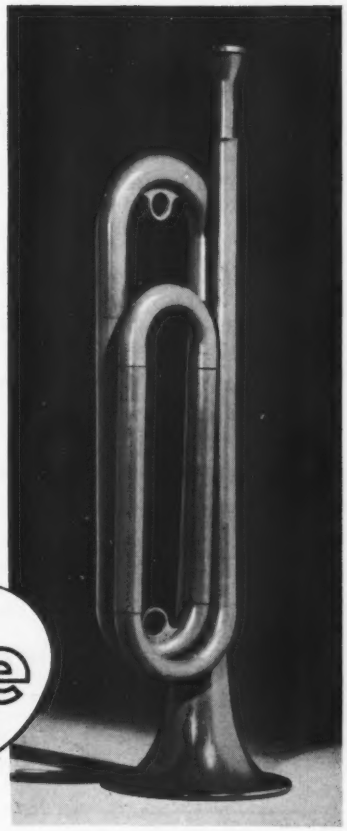

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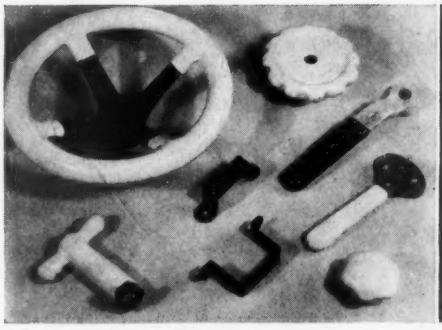

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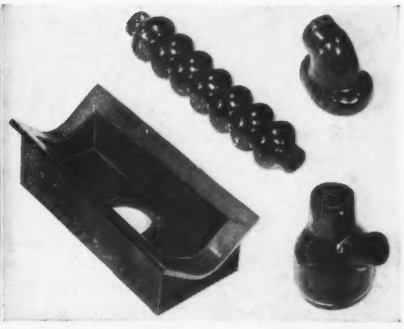

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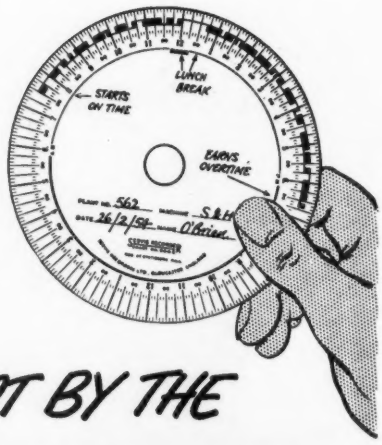

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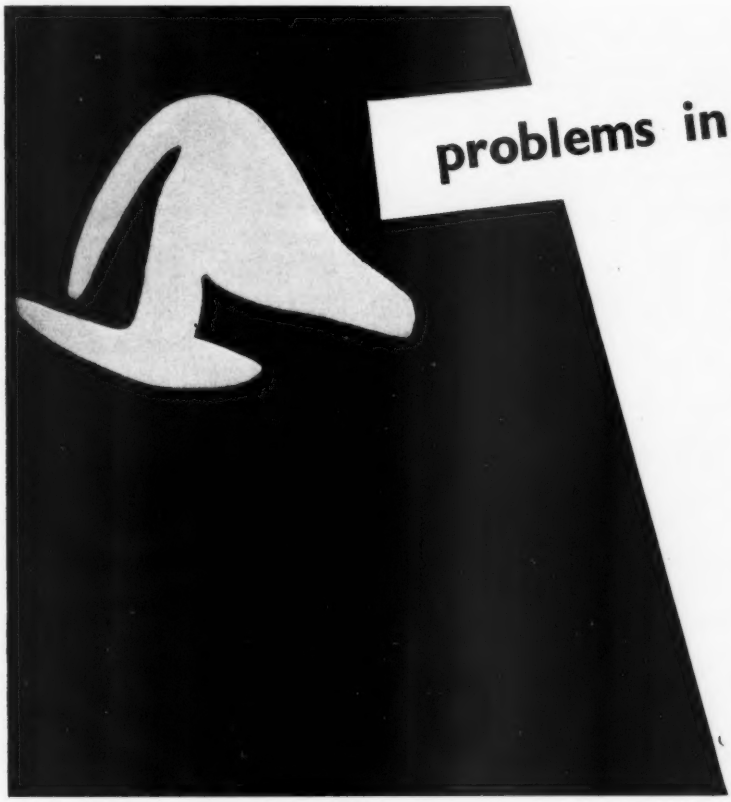

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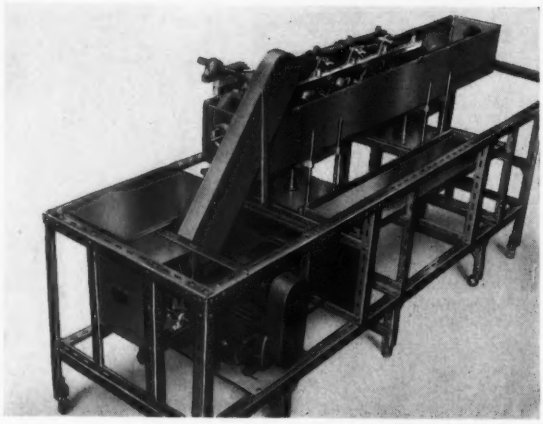

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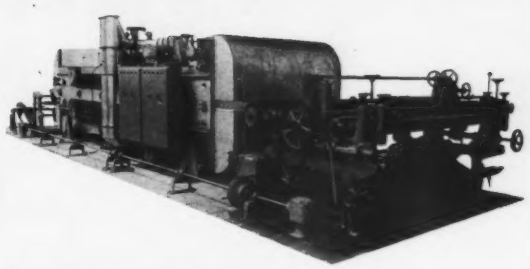

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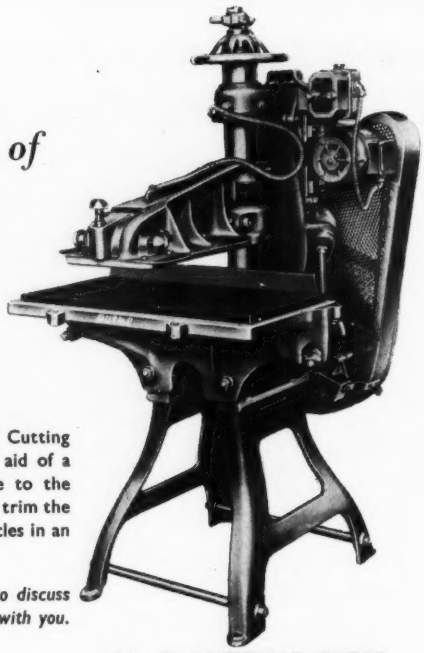

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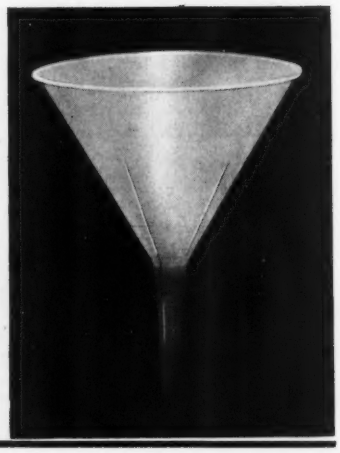

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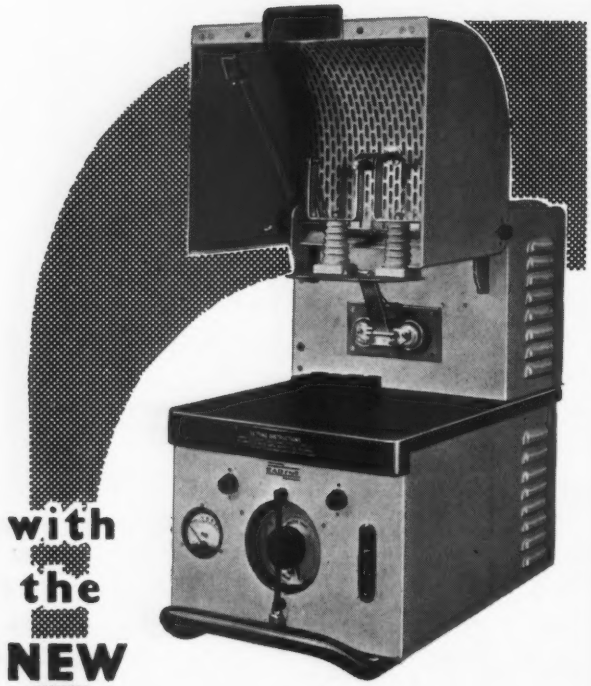

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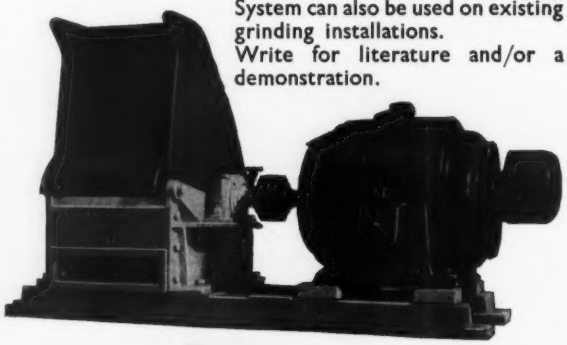

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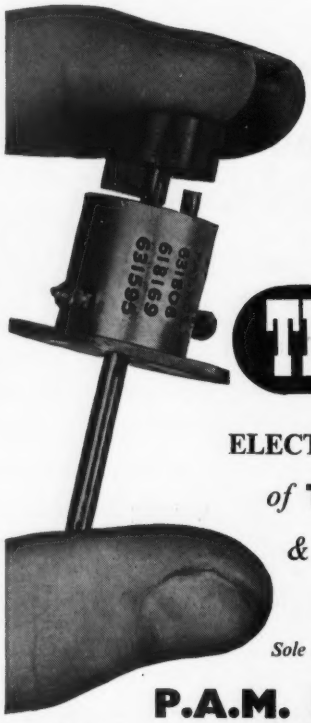

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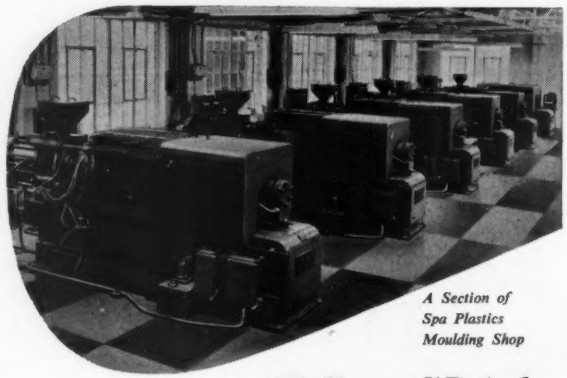

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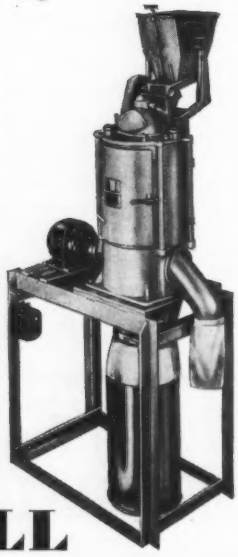

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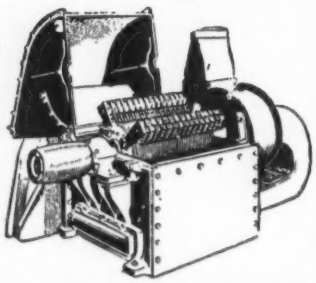

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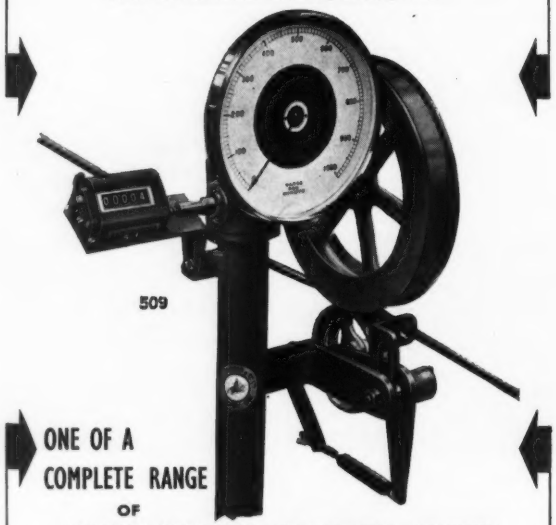

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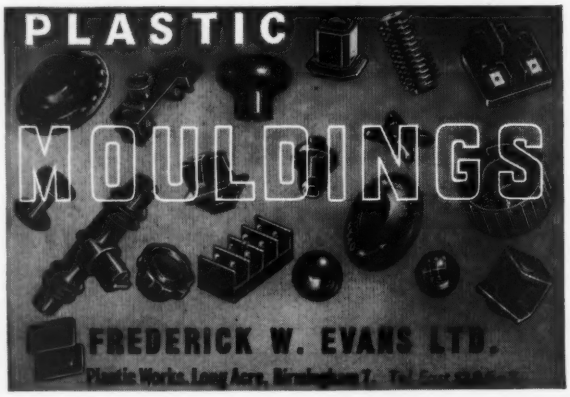

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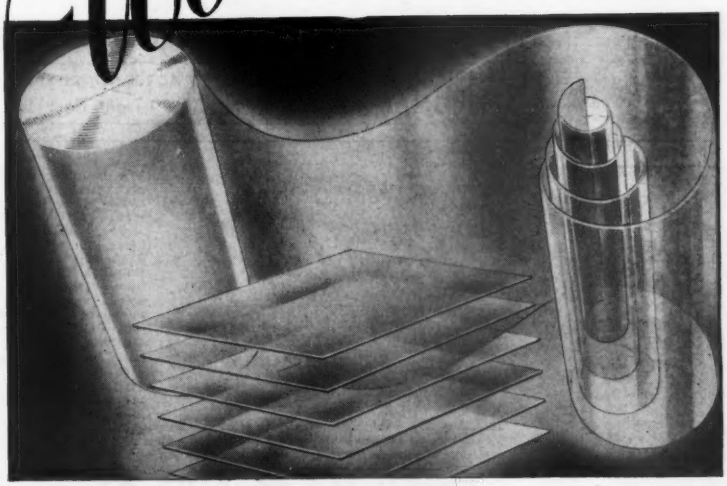

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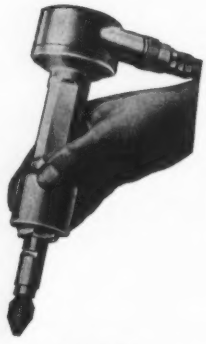

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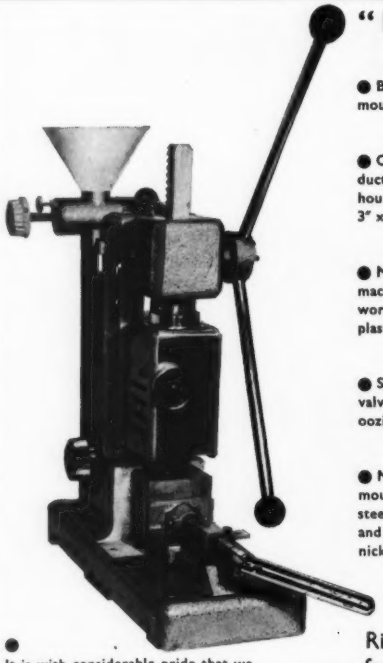

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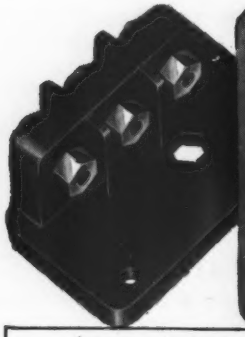

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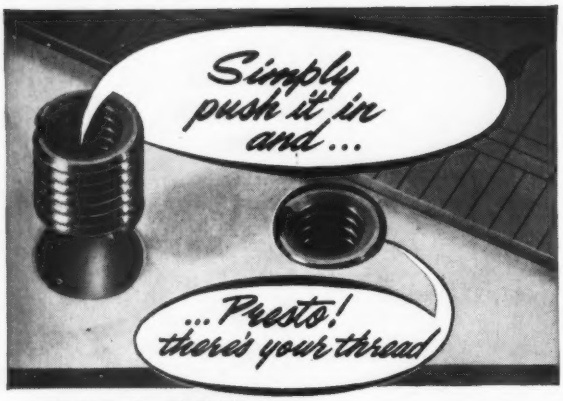

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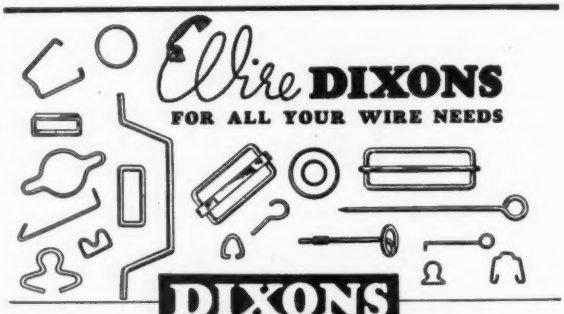

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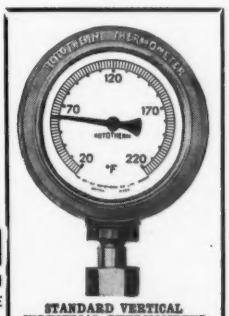

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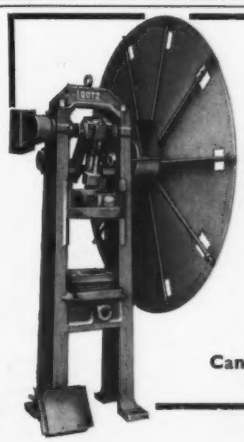

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JOHN DALE, LTD., New Southgate, N.11, have acquired from Flexipac, Ltd., the rights to manufacture in Great Britain, Canada and Switzerland, plastic collapsible tubes under the processes patented in those countries by the latter company. 230-9

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SHEETS UP TO 1 IN. THICK.
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RAW MATERIAL WANTED

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DO YOU HAVE ANY PLASTIC SCRAP TO SELL? Or are you looking for some to buy? Then contact Michael St. Stevens, Ltd., Keswick Rd., S.W.15. Phone, Vandyke 3345-6. zzz-303

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DEVELOPMENT OF USE OF NON-METALLIC MATERIALS IN CHEMICAL PLANT

Graduate Chemical or Mechanical Engineer or Metallurgist required to initiate and carry out plant and laboratory trials on non-metallic materials (plastics, laminates, ceramics, cements, heat-insulation) with a view to their application in existing and projected chemical plant. It is preferred that applicants should have chemical works and plant design experience and some knowledge of non-metallic materials, chemistry and metallurgy. Age 25–35.

The appointment is to the permanent staff, five-day week, with good salary, first-class working conditions and recreational facilities. Contributory pension fund and profit-sharing schemes. Limited assistance with removal expenses for married men. Apply for official application form to Staff Manager, quoting reference MET/DEV, at I.C.I., P.O. Box No. 7, Winnington, Northwich, Cheshire. 230-5143

AN established company in the London area manufacturing synthetic resins needs a Works Manager. The man required must have at least 10 years' experience in a similar industry or in a chemical works, should be 35–40 years of age and preferably a qualified Chemical Engineer. The post offers scope for advancement in an expanding industry, but the man selected must be capable of completely reorganizing the production of the company on his own initiative. Salary will be paid in accordance with qualifications and experience, but not less than £1,500. Box P304, care of " Plastics." 230-3

ASSISTANT required to Sales Manager of leading public company marketing plastic film, plastic packaging materials, plastic coated fabrics, plastic extrusions, etc. The position will call for qualities of imagination, a high degree of initiative and the primary duties will be order collation, order progressing and general correspondence. Experience in the plastic field an advantage. The situation is superannuated and salary will be commensurate with experience. Please apply in writing giving full details of past experience and salary required to Box P302, care of " Plastics." 230-4

FOREMAN required for small compression moulding shop approximately 30 miles from London. Must be fully experienced. Permanent position. Write Box P3012, care of " Plastics." 232-5172

DESIGNER-DRAUGHTSMEN required by London Firm of Extruder Manufacturers supplying Machinery for Pipe, Film, Tubing, Dies, Haul Offs and ancillary Equipment. Must have had a few years' experience in this field. Progressive positions with non-contributory Staff Pension Scheme and pleasant working conditions. Apply in confidence, giving age, qualifications, salary required, etc., to N. Browne, Bone Brothers, Limited, Manor Farm Road, Alperton, Wembley. 232-5169

Situations Vacant (contd.)

RUBBER ENGINEERING FOREMAN required, Foreman engineer to take charge, under the Chief Engineer, of engineering machine shop, factory plant maintenance, machinery installation, and process steam plant in medium-size rubber works in East London area. Must be good disciplinarian and education to National Certificate standard. Experience in similar works desirable but not essential. State age, experience and salary required. All applications will be treated in strict confidence. Reply to Box P301, care of " Plastics." 230-5

EUROPEAN REPRESENTATIVE to be resident on Continent required by Company manufacturing Machinery for the Rubber and Plastics Industry. Knowledge of Calendering and Extrusion of Rubber and Plastics desirable. Fluent French, German and Italian. Write to Box P303, care of " Plastics." 230-6

UNION CARBIDE, LIMITED

Required for Polyethylene Plant in course of erection at Grangemouth:

MECHANICAL AND CHEMICAL ENGINEERS.

Degree men necessary in age groups 25/30 years. Training period in America to prepare for future plant operation.

Applications in confidence to 103 Mount Street, London, W.1.

230-13

FIBREGLASS, LIMITED, require a Technical Representative for reinforced plastics to work in the South of England.

The successful applicant, based on the London Office, will be required to travel extensively in the area.

He should have a good knowledge of chemistry or physics, and mechanical engineering, and some commercial experience. Previous contact with the reinforced plastics trade would be an advantage.

Apply, stating age, experience and salary required, to the Sales Director, Fibreglass, Limited, St. Helens, Lancashire. 230-14

SALES AND DEVELOPMENT ENGINEER required with knowledge of mixing, calendering and extrusion of rubber and plastic materials, car provided. Write Sales Manager, Francis Shaw & Co., Ltd., Corbett Street Works, Manchester, 11. 230-16

RUBBER IMPROVEMENT, LIMITED, require a first-class Representative with knowledge of the marketing and sales promotion of P.V.C. Film, Rigid Sheet, and Semi-Rigid Foil, to P.V.C. Garment, Fancy Goods, Moulding, Vacuum Forming, Lamp Shade and allied trades in London and Home Counties. A live connection with these trades is desirable, and applicants are required to have a sound knowledge of P.V.C. products generally. The position carries a good salary and commission. Non-contributory Pension and Life Insurance Scheme in operation. Apply in confidence to Sales Director, Rubber Improvement, Ltd., Wellingborough. 230-19

PLASTICS DEVELOPMENT ENGINEER OR PLASTICS TECHNOLOGIST required, with thorough knowledge of Thermosetting and Thermoplastic materials and their correct application in the moulding field. A.P.I. qualifications preferred. Please write stating experience and salary required to The Managing Director, British Moulded Plastics, Limited, Avenue Works, Walthamstow Avenue, London, E.4. 230-20

ASSISTANT CHEMIST required for Process Control testing of thermoplastics; previous experience, including colour matching, an advantage but not essential. Apply stating qualifications, age, present salary, to The Personnel Manager, Stanley Smith & Co., Worple Road, Isleworth, Middlesex. 230-22

BRITISH INSULATED CALLENDER'S CABLES, LIMITED, are establishing a Cable Accessories Development Section within the Thermoplastic Cables Division at their Helsby Works in Cheshire to further the development of Polypole Couplers, and applications are invited for the following posts:—

(*a*) Section Head who should be an experienced Design Engineer. Age range 28/40. Preferably familiar with polythene and/or epoxy moulding techniques. The successful applicant would be responsible to the Divisional Technical Manager for design and laboratory facilities and a small model shop.
(*b*) Technical Assistant for the development of moulding and assembly techniques.
(*c*) Staff Mechanic who should have served an Apprenticeship to take charge of the model shop.

Applications in writing, quoting reference H/54/56, should be addressed to the Staff Officer, B.I.C.C., Ltd., Prescot, Lancs. 230-23

Situations Vacant (contd.)

FIRST-CLASS MOULD DESIGNER AND CHECKER for Trade Injection Moulding firm required immediately by Company moving to Stevenage beginning 1957. Accommodation available. Good salary to right man. Write stating full details of experience and salary required to Box P3013, care of " Plastics." 230-25

WELL Educated Young Man of Smart Appearance, aged 21–30 years, required to train as Sales Representative for well-known Company of Extruders of Thermoplastics. Area to be covered, London and Home Counties, Previous experience an advantage but not essential. Good Prospects, and Pension Scheme under consideration. Box P3016, care of " Plastics." 230-27

IMPORTANT Chemical Manufacturers require a Chemist for the duties of Technical Sales Representative, having experience of P.V.C.; its application and processing. A good salary commensurate with this senior appointment is offered. A car will be provided. Duties will require travels throughout the U.K. and may include visits to continental customers. Please submit full details in the first instance to Box P3015, care of " Plastics." 230-28

VACUUM Forming and Shaping Department of leading firm in the plastics industry require a Chargehand in this Department. Applicants should have had some experience of both pressing and vacuum forming, have good personality and keenness to carry out some development. Primary requirement, however, is for knowledge of work, with good self-discipline and ability to control others. Please reply in the first instance giving particulars of age, marital status, experience and wages, to Box P3011, care of " Plastics." 230-30

FOREMAN with experience of P.V.C. Extrusion required for factory situated in Northamptonshire. Must have practical experience of Modern Plant and Labour Control. Non-contributory staff pension and life insurance scheme in operation. Box P308, care of " Plastics." 230-32

AGENT REQUIRED, Commission basis, to represent capable moulders. Must have suitable connections, with buyers of mouldings. Exclusive and sole territory granted. Write Box P2914, care of " Plastics." 234-05144

TECHNOLOGIST required with practical plastics experience for development work covering the field of extrusion and ancillary equipment. Progressive position with non-contributory Staff Pension Scheme and pleasant working conditions. Apply in confidence giving age, qualifications, salary required, etc., to N. Browne, Bone Brothers, Limited, Manor Farm Road, Alperton, Wembley. 232-5170

Situations Vacant (contd.)

TEXTILE Machinery Manufacturers in North-east Lancashire require Plastics Engineer fully conversant with fibreglass moulding technique. Five-day working week. Non-contributory Pension Scheme. Excellent welfare facilities. Apply stating age, salary required, experience, etc., to the Secretary, Howard & Bullough, Limited, Globe Works, Accrington, Lancs. 230-X1868

DRAUGHTSMEN. Plastic mould design draughtsmen, experienced on all types of tools, methods and materials, are urgently required by a leading London moulder. Salaries available are well above average and permanent positions are offered to first-class men. Apply: Personnel Manager, British Moulded Plastics, Ltd., Walthamstow Avenue, E.4. Phone, 2323. 230-48

SALES ENGINEER required, 30 or under, interested in developing sales of Plastics Extrusions on full-time basis to industrial users in Midlands and North. Some knowledge of plastics an advantage but not essential, as initial training will be given to successful applicant. Salary, expenses and commission basis. Write giving details, age, qualifications, career to date, to High Duty Plastics, Ltd., Morden Rd., Mitcham, Surrey. 230-49

TURNER BROTHERS ASBESTOS CO., LTD., LEIGH RD., HINDLEY GREEN, NR. WIGAN,
have a number of interesting vacancies in their expanding
PLASTICS RESEARCH DEPARTMENT.
Applications are invited from technologists at all levels but we are particularly interested in:—
SENIOR ASSISTANTS possessing A.R.I.C. or a B.Sc. degree, to work on the development of re-inforced plastics.
These are all staff appointments offering excellent prospects for promotion in a developing organization. Apply in writing to Personnel Officer, quoting reference P.R.D.I. 230-50

PLASTICS ENGINEER. A vacancy occurs for a Plastics Engineer experienced in injection moulding techniques, moulding problems and machine maintenance. This is an opportunity to join a progressive and expanding firm of injection moulders 30 miles from London. Pension scheme and housing accommodation offered. Please state experience. Replies kept confidential. Box P292, care of " Plastics." 231-5174

A QUALIFIED ENGINEER with commercial experience required to start production in Tank lining, Ducting in Polythene and P.V.C. Write in confidence to Box 3026, care of " Plastics." 230-54

Situations Vacant (contd.)

" THE PETROLEUM TIMES." Established 1899. A vacancy exists for a qualified man on the technical editorial staff. Age 30–40. Sound knowledge and experience of oil industry essential. Ability to write good English with ease. Knowledge of languages helpful. Applications will be treated in confidence. Write giving full details of career, interests and present salary to the Managing Editor, " The Petroleum Times," Brettenham House, Lancaster Place, Strand, W.C.2. 230-1111

BRITISH RESINS PRODUCTS LIMITED, Hayes Road, Sully, near Penarth, have a vacancy for a **CHEMIST** in their Moulding Powder Division and invite applications from people with experience of thermosetting materials. Pleasant semi-rural location. Good salary, non-contributory pension scheme. State full details, age, experience, positions held, in confidence to Staff Manager. 230-59

TECHNICALLY QUALIFIED SALESMAN with Chemical Engineering background is required to represent London-based Company selling branded quality acid resisting plastic pipe. This is a key position with a young and growing Company manufacturing a new but proved material, and offers excellent prospects for the right type of man, who must be prepared not only to establish and maintain customer relations with major Companies, but also to discuss associated technical problems intelligently. Applicants should give full details of education, qualifications and experience, also salary required, to Box P3031, care of " Plastics." 230-57

SITUATIONS WANTED

ENGINEER AGENT will follow up enquiries in the North-west. Box P3027, care of " Plastics." 230-51

INJECTION MOULDING FOREMAN desires situation London area. Fully experienced and capable of taking complete charge. Box P3033, care of " Plastics." 230-x2255

CHARTERED MECHANICAL ENGINEER, experienced design, construction, and selling extruders, and ancillary equipment, open to consider suitable appointment. Interested to enter layflat field. Box P3034, care of " Plastics." 230-1111

TIME RECORDERS

FACTORY TIME RECORDERS. Service rental. Phone, Hop 2239. Time Recorder Supply and Maintenance Co., Ltd., 157–158 Borough High St., S.E.1. 233-1190

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EDITORIAL AND BUSINESS NOTICES

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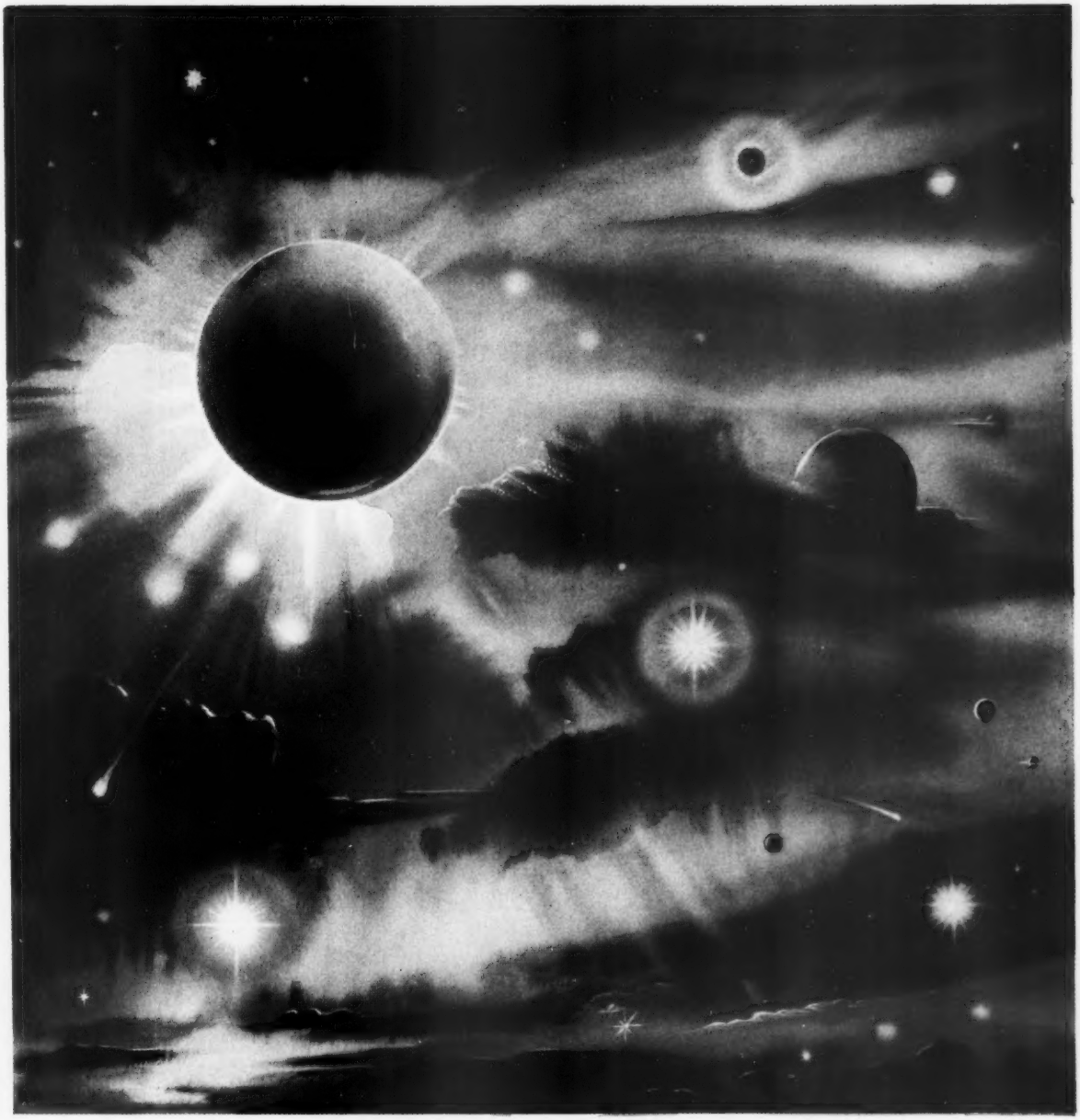

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